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ABSTRACT

In 1984 the Urban Mathematics Collaborative (UMC) project was initiated to improve mathematics education in inner-city schools and to identify new models for meeting the ongoing professional needs of teachers. UMCs are located in Cleveland, Minneapolis-St. Paul, Los Angeles, Philadelphia, San Francisco, Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans. In addition, two other projects were established: a Documentation Project to monitor the activities of the new collaboratives and a Technical Assistance Project to serve as a source of information for the collaborative projects. In each of the 11 cities, the UMC project supports collaboration among groups of mathematicians from high schools, higher education institutions, and industries, and encourages teacher participation in a broadly based local mathematics community. This report presents an overview of the efforts of the UMC project as a whole, as well as a brief description of each of the collaboratives and the Technical Assistance Project. The Appendix of the report includes a detailed progress report for each of the projects for the 1986-87 school year. (PK)

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Program Report 88-1

THE URBAN MATHEMATICS COLLABORATIVE PROJECT: REPORT TO THE FORD FOUNDATION ON THE 1986-87 SCHOOL YEAR

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Thomas A. Romberg, Allan J. Pitman,
and Steven R. Williams

Report from
the Urban Mathematics Collaborative Documentation Project

Wisconsin Center for Education Research
School of Education
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Madison, Wisconsin

January 1988

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Wisconsin Center for Education Research

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I. INTRODUCTION

In 1984, the Ford Foundation initiated the Urban Mathematics Collaborative (UMC) project to improve mathematics education in inner-city schools and to identify new models for meeting the ongoing professional needs of teachers. In February, 1985, the Ford Foundation awarded five grants to establish urban mathematics collaboratives in Cleveland, Minneapolis-St. Paul, Los Angeles, Philadelphia and San Francisco. In addition, the Ford Foundation established a Documentation Project to monitor the activities of the new collaboratives and a Technical Assistance Project (TAP) to serve as a source of information for the collaborative projects (Romberg & Pitman, 1985). During the next eighteen months, UMC projects were funded in Durham, Pittsburgh, San Diego, St. Louis, Memphis, and New Orleans, bringing to eleven the total number of urban mathematics collaboratives (Romberg, Webb, Pitman, & Pittelman, 1987). A map of the UMC project appears in Figure 1.

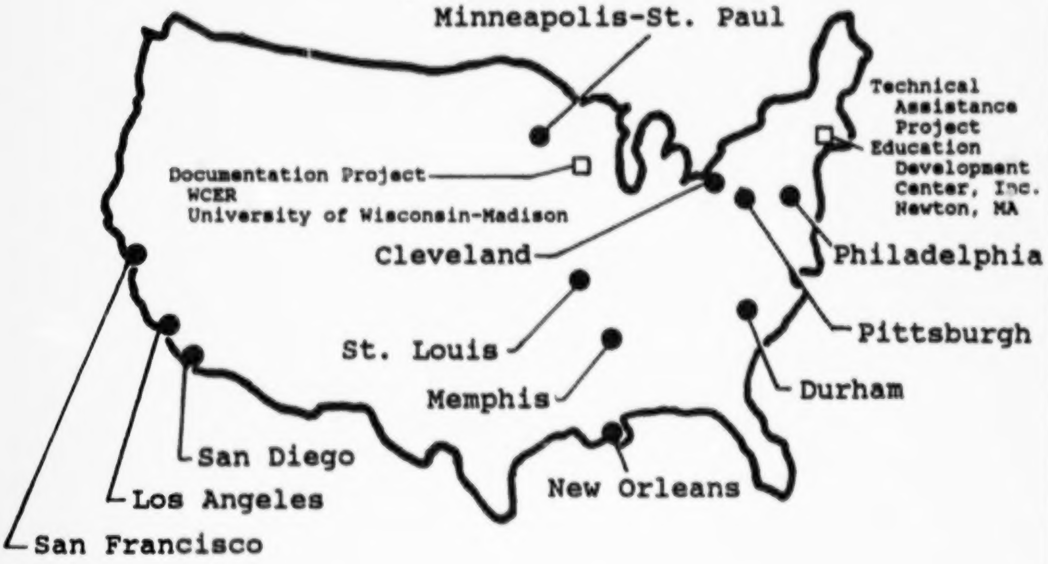
In each of the eleven cities, the UMC project supports collaboration among groups of mathematicians from high schools, higher education institutions, and industries, and encourages teacher participation in a broadly based local mathematics community. The teacher remains the centerpiece of the educational enterprise but--especially in inner-city schools--is likely to be overworked, lacking in support services and material resources, and isolated from other teachers, other professional adults, and changing ideas about mathematics.

The collaborative project is rooted in the premise that collegiality among professional mathematicians can reduce teachers' sense of isolation, foster their professional enthusiasm, expose them to a vast array of new developments and trends in mathematics, and encourage innovation in classroom teaching. The Ford Foundation's concomitant commitment of human and financial resources provides the needed support network to allow such collegiality to take place.

The urban mathematics collaboratives have assembled local resources--both financial and human--and have configured them in a variety of ways to explore new modes of professionalism for teachers and new kinds of relationships between high school mathematics teachers and the professional users of mathematics in higher education and in business. Considered individually, the collaboratives are unique, locally controlled projects. Together, they comprise an efficient, cost-effective, and comprehensive field experiment that will contribute valuable knowledge to the specific teachers involved, and serve as a testing ground for new modes of enhancing teachers' knowledge about mathematics and professionalism.

THE URBAN MATHEMATICS COLLABORATIVE PROJECT

Funded by
The Ford Foundation


Minneapolis-St. Paul
Technical Assistance Project
Education Development Center, Inc.
Newton, MA
Documentation Project
WCER
University of Wisconsin-Madison
Cleveland
Philadelphia
St. Louis
Pittsburgh
Memphis
Durham
San Diego
New Orleans
Los Angeles
San Francisco

- Cleveland Collaborative for Mathematics Education (C^2ME)
  Cleveland, Ohio
- Durham Collaborative: The Durham Mathematics Council
  Durham, North Carolina
- Los Angeles Urban Mathematics/ Science Collaborative (LAUM/SC)
  Los Angeles, California
- Memphis Urban Mathematics Collaborative
  Memphis, Tennessee
- New Orleans Mathematics Collaborative (NOMC)
  New Orleans, Louisiana
- Philadelphia Math Science Collaborative
  Philadelphia, Pennsylvania
- Pittsburgh Mathematics Collaborative
  Pittsburg, Pennsylvania
- St. Louis Urban Mathematics Collaborative
  St. Louis, Missouri
- San Diego Urban Mathematics Collaborative
  San Diego, California
- San Francisco Mathematics Collaborative
  San Francisco, California
- Twin Cities Urban Mathematics Collaborative
  Minneapolis-St. Paul, Minnesota

Figure 1. The Ford Foundation National Network of Urban Mathematics Collaboratives.

Consonant with the Foundation's original intent, each of the eleven collaboratives has been encouraged to develop as a unique program, drawing on local resources, exploiting local strengths, and addressing local weaknesses. As the effort continues, it will focus more specifically on the effects of the developing networks on the professional lives of the participating teachers and on the identification of issue-based outcomes. The Foundation's intent in the UMC effort is in keeping with the recommendations of the Conference Board of the Mathematical Sciences (1984):

> The Conference recommends the establishment of a nationwide collection of local teacher support networks to link teachers with their colleagues at every level, and to provide ready access to information about all aspects of school mathematics. (p. 5)

The broad sense in which the term colleague is used is exemplified by the objectives "strongly endorsed by the Conference":

- to extend the sense of professionalism among teachers by building a support system that links them to colleagues in the mathematical sciences, inside and outside of the schools;
- to provide teachers at all levels with colleagues upon whom they can call for information concerning any aspect of school mathematics; and
- to enable teachers to enlarge their views of mathematics, their source of examples, and their repertoire of classroom skills in communicating mathematics. (CBMS, 1984, p. 15)

It has been the Foundation's aim to involve virtually all of each participating site's high school mathematics teachers in a diverse set of school-year and summer activities, jointly designed and operated by teachers and mathematicians from educational, cultural, and business institutions. In these networks, mathematics teachers will be participants who bring to this exchange their unique viewpoint and experience, rather than clients who "receive" information from other partners in the relationship.

The Documentation Project records the progress of each collaborative in defining, redefining, and refining its focal concerns. The efforts of each project, as well as those of the Ford Foundation itself, merit study for three reasons. First, each project and the Ford Foundation need to be kept informed about what is happening; ongoing activities, the strategies employed, and the effects of those activities on the professional lives of teachers and other project participants need to be documented in order to be shared. Second, it is important for the projects, the Ford Foundation, and the educational policymaking community to understand the characteristics and relationships inherent within each project. Because changes occur slowly over time, the activities, the actual changes in behavior, the anticipated and unanticipated outcomes, and the impediments encountered under varying circumstances must be identified and studied. Third, although we expect each site to be unique, we are confident that the data will enable us to identify project activities and strategies that can be generalized to different settings. By encouraging mathematics teachers to act as self-directed professionals, the collaboratives are providing lessons that can be applied to teachers of all subjects.

On-site data about the collaboratives' activities has been collected from a variety of sources, including:

1. the directors and coordinators of each project;
2. the on-site observers from each project (reflecting the teachers' perspectives);
3. visits by the staff of the Documentation Project;
4. joint meetings with personnel from the Ford Foundation and the Technical Assistance Project;
5. meetings of the project directors;
6. meetings of representatives of all of the projects; and
7. surveys administered to participating teachers.

This report presents an overview of the efforts of the UMC project as a whole, as well as a brief description of each of the collaboratives and the Technical Assistance Project. The Appendix of the report includes a detailed progress report for each of the projects for the 1986-87 school year.

II. PROJECT DESCRIPTIONS

A brief description of each of the eleven Urban Mathematics Collaboratives is presented in this section. A description of the Technical Assistance Project follows. (A more detailed report of each collaborative is appended to this paper.)

Cleveland Collaborative for Mathematics Education (C^2ME)

Director: Ms. Paula C. Fay
Coordinator: Ms. Suzanne Haggerty
On-Site Observer: Mr. Robert Seitz
Funding Agent: The Cleveland Education Fund
Date of Initial Funding: February 1, 1985

The Cleveland Collaborative for Mathematics Education (C^2ME) was one of the five original collaboratives established in 1985. The collaborative, which serves the approximately 200 secondary mathematics teachers in the Cleveland Public Schools, is administered through the Cleveland Education Fund.

C^2ME's purpose is to enhance the quality of secondary mathematics education in the Cleveland Public Schools by finding new ways to integrate community resources into the teaching process, and to define new models for meeting the continuing professional needs of teachers. The C^2ME Four-Year Work Plan for 1986-90 stated its Mission as: "To enhance the professionalism and effectiveness of secondary school mathematics teachers by providing opportunities for training, information, collegiality, and networking that will enable them to deliver a contemporary mathematics education."

An Advisory Board and a Teacher Advisory Board provide input to the collaborative's director and project coordinator. The Advisory Board, which oversees the operation of C^2ME, is comprised of representatives of science, education, and business, including seven mathematics teachers from the Cleveland Public Schools. The eleven-member Teacher Advisory Board was established in early 1986 to assist the collaborative in developing its long-range plans and future activities; teachers were selected to serve on the board based on their pattern of participation in C^2ME's programs and on their dedication to excellence in mathematics education in the Cleveland Public Schools.

During the 1986-87 school year, C^2ME offered a wide variety of activities designed to provide teachers with opportunities for training, information, collegiality, and networking with other teachers, as well as with mathematicians from business, industry, and higher education. The collaborative sponsored a series of dinner symposia, initiated a mathematics competition for students, provided access for teachers to attend workshops at Oberlin College, Baldwin Wallace College, and other local colleges, and supported mathematics contests. In addition, the collaborative encouraged participation in the Cleveland Teachers Internship Program and helped to facilitate the awarding of tuition scholarships for higher education, as well as small grants, to teachers in the Cleveland Public Schools. The collaborative has established a multi-purpose Resource Center for mathematics teachers and publishes its own quarterly newsletter.

Durham Collaborative: The Durham Mathematics Council

Director: Dr. J. Keith Brown
Executive Director: Dr. Jo Ann Lutz
On-Site Observer: Ms. Betty Peck
Funding Agent: The North Carolina School of Science
and Mathematics
Date of Initial Funding: August 1, 1985

The Durham Mathematics Council was established in August, 1985, as the sixth collaborative in the Urban Mathematics Collaborative project. The collaborative, which serves more than 100 secondary mathematics teachers in the Durham city and county school systems, is administered through the North Carolina School of Science and Mathematics.

Since its inception, the project has identified five major areas for involvement to enhance professional growth for secondary school mathematics teachers. They are: enhancement of knowledge about local mathematics applications; expansion of currently limited opportunities for teachers to travel; support for teachers' growth as mathematicians; provision of opportunities for professional collegiality; and combating "burnout" and loss of professional self-esteem.

The project director and the executive director receive assistance in administering the affairs of the collaborative from the Board of Directors. The sixteen-member Board of Directors is comprised of representatives from area businesses, higher education, and the city and county school districts, including two teachers. The Steering Committee, comprised of one teacher from each school, was established to provide a direct link between the teachers and the collaborative administration.

The programs of the Durham Mathematics Council are designed to encourage junior and senior high school mathematics teachers to communicate with their colleagues in all areas of professional mathematics. Since its establishment, the council has sponsored seminars, workshops, and corporate-facility tours in North Carolina's Research Triangle area, using the resources offered by area businesses and universities. In summer, 1986, the council initiated an industry internship program and supported teacher participation in university study. Other activities included sponsoring seminars, workshops, and grants, establishing a Teacher Resource Center and efforts related to initiating the Triangle Mathematics Club. Throughout the 1986-87 school year, the council supported teacher attendance at professional meetings.

Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC)

Executive Director: Ms. Peggy Funkhouser
Coordinator: Ms. Toby Bornstein
On-Site Observer: Mr. Richard Curci
Funding Agent: Los Angeles Educational Partnership
Date of Initial Funding: February 1, 1985

The Los Angeles Urban Mathematics/Science Collaborative (LAUM/SC) was organized in mid-1986 as a result of a restructuring and reorientation of the Los Angeles Urban Mathematics Collaborative, which was established in 1985 as one of the five original collaboratives. LAUM/SC is the official title of the thirty-five-member Advisory Committee to the funding agent, the Los Angeles Educational Partnership. The collaborative is responsible for four programs, one of which is the Ford Foundation-sponsored +PLUS+ (Professional Links with Urban Schools). The Advisory Committee is comprised of lead teachers from +PLUS+, Board of Education members, and representatives of the school districts directly involved, the County Office of Education, and foundations, museums, corporations, professional organizations, and postsecondary institutions.

The collaborative serves not only the entire Los Angeles Unified School District (LAUSD) but several nearby districts as well. Because of the massive potential target population, the collaborative's +PLUS+ program initially directed much of its attention to the mathematics departments in three high schools. The departments in these schools have formed +PLUS+ teams with business and postsecondary associates. In spring, 1987, five more schools were identified to participate. The +PLUS+ initiative involves two major efforts, one directed at the mathematics departments in the eight target schools and another at the mathematics teachers in forty-seven high schools in the Los Angeles area.

The goal of +PLUS+ is to assist teachers to relate the world of work to the mathematics curriculum and to benefit from expanded mathematical horizons through interaction with colleagues in a mathematics resource network. Within the +PLUS+ program, steering committees plan activities; these committees are comprised of teachers and business and college associates, all of whom are considered members of the +PLUS+ program. Members of the +PLUS+ teams in each of the target schools work together to prepare and execute plans for teachers' professional development. Considerable effort has been expended on building these teams, with the goal of creating and consolidating departmental cohesion. To this end, a series of dinner meetings with invited speakers was organized by and for the teams. Departments in target schools agreed to define needs, explore resources, and develop a program of activities as prerequisites for financial support.

The efforts of teachers in the +PLUS+ program during the 1986-87 school year focused on planning a series of four mathematics content workshops for all regional mathematics teachers. Teachers served on planning teams for each workshop topic and in many cases also served as workshop coordinator. The collaborative also initiated a pilot summer internship program and funded attendance of +PLUS+ teachers at several local and national conferences.

Memphis Urban Mathematics Collaborative

Executive Director: Mr. Herman Ewing
Project Director: Ms. Nancy Gates
On-Site Observer: Ms. Rita Ross (appointed January, 1987)
Funding Agent: Memphis Urban League, Inc.
Date of Initial Funding: September 1, 1986

The Memphis Urban Mathematics Collaborative, which was the last collaborative to join the UMC project, serves a population of approximately 345 mathematics teachers in the Memphis City Schools, although its initial efforts have focused on the mathematics teachers in twenty targeted schools. The collaborative is administered through the Memphis Urban League, Inc.

The collaborative's goal is to promote professionalism among mathematics teachers and to assist them in broadening their horizons through creative relationships with other mathematics professionals.

The organizational structure for the collaborative has evolved over the course of its first year. The collaborative is governed by a nineteen-member Advisory Committee comprised of five teachers, five mathematics professors, and representatives from higher education, business, the school district administration, and the Urban League. Subcommittees of the Advisory Committee develop ideas for collaborative activities. The four subcommittees established are: Speakers Bureau, Resource Associate, Summer Workshops, and Internship. Plans are underway for the formation of a Teacher Committee. The Teacher Committee, to be composed of thirteen teachers, will provide a means of getting input from teachers in regard to the activities the collaborative should be planning.

During the 1986-87 school year the collaborative initiated several programs, including establishing a Speakers Bureau and printing a Speakers Bureau Directory, placing forty teachers with a college or business Research Associate, planning summer internships for four teachers, and planning a series of four workshops for the summer.

New Orleans Mathematics Collaborative (NOMC)

Director: Ms. Constance Barkley
Coordinator: Dr. Olympia Boucree
On-Site Observer: Ms. Aldonia Winn
Funding Agent: The Metropolitan Area Committee (MAC) Foundation
Date of Initial Funding: September 1, 1986

The New Orleans Mathematics Collaborative was the tenth collaborative to be funded by the Ford Foundation. The collaborative, which serves the approximately 150 senior high school mathematics teachers in the Orleans Parish Public Schools system, is one of four programs coordinated by the Metropolitan Area Committee Education Fund.

The goals of the collaborative are to enhance the professional development of the mathematics teachers and to enrich the teaching of mathematics. These are to be achieved by providing teachers with opportunities to develop networks of mathematicians, to work in collaboration with other teachers and mathematicians, to keep abreast of developments in mathematics and teaching, and to experience mathematics usage outside an academic setting.

The collaborative is governed by a twenty-member Steering Committee of teachers, district administrators, and representatives from the teachers' union, businesses, universities, and the Louisiana Science Centre. The Chair is a member of the MAC Education Fund Board. Four subcommittees oversee the collaborative's activities. They are: symposia, site visits and internships, workshops, and newsletter.

During the 1986-87 school year, the New Orleans Mathematics Collaborative offered a wide variety of activities, including a November 18 reception at the Louisiana Science Centre to officially launch the project, a symposium series, site visits to local businesses and industries, and several workshops. In addition, the collaborative encouraged teachers to apply for mini-grants and published its own newsletter.

Philadelphia Math Science Collaborative

Director: Dr. Wayne Ransom
Coordinator: Ms. Sue Stetzer
On-Site Observer: Ms. Joyce Neff
Funding Agent: The Franklin Institute
Date of Initial Funding: February 1, 1985

The Philadelphia Math Science Collaborative was formed in fall, 1986, through a restructuring and reorientation of the Philadelphia Mathematics Collaborative, one of the original five collaboratives. The collaborative, which serves mathematics and science teachers in six target high schools in the School District of Philadelphia, is administered through the Franklin Institute.

The goals of the Philadelphia Math Science Collaborative are to promote teacher leadership and team building and to contribute to a vision of mathematics teaching in the future. Specifically, the collaborative hopes to: (1) develop, evaluate, and document the position of an in-school collaborator who would facilitate communication and serve as a catalyst for change and (2) increase teacher participation in extramural professional development programs which offer partnership between teachers and their colleagues in academia and industry, opportunities to enhance knowledge, skills, and professionalism, and new ideas for mathematics instruction. The collaborative also hopes to develop a model for documenting the impact these two programs will have upon the quality of teachers' professional lives.

The collaborative is governed by a twenty-four-member Advisory Council, consisting of one teacher from each of the target schools, as well as representatives from various local colleges, businesses, the school district, PRISM (Philadelphia Renaissance in Science and Mathematics), and professional organizations. The Advisory Committee meets bimonthly to help evaluate and reshape existing programs, and to design new programs with an eye toward providing support to the coordinator and direction for the collaborative.

In addition to encouraging teachers to participate in the many programs provided for them by other organizations in the Philadelphia area and providing teachers in the target schools free memberships in their local professional organizations, the collaborative has offered several activities during the 1986-87 school year aimed specifically at the targeted teachers. These programs include mini-grants which enable teachers to attend professional meetings, workshops, and seminars; monthly departmental meetings, which have included guest speakers and reviews of educational software; a newsletter; a teacher's network for mathematics in applications; and a clearinghouse service that keeps teachers notified of resources for classroom use.

Pittsburgh Mathematics Collaborative

Project Coordinator: Dr. Leslie Salmon-Cox
Assistant Project Coordinator: Dr. Martina Jacobs (through March 31, 1987)
Barbara Bridge (appointed April 15, 1987)
On-Site Observer: Ms. Rosemarie Kavanagh
Funding Agent: Allegheny Conference on Community Development
Date of Initial Funding: September 1, 1985

The Pittsburgh Mathematics Collaborative, serving the 126 high school mathematics teachers in the Pittsburgh public schools, was the seventh collaborative to be established. The collaborative is administered through the Allegheny Conference Education Fund, which is part of the Allegheny Conference on Community Development.

Six goals provide a focus for the collaborative: to overcome teachers' isolation through increased opportunities for interaction; to educate the community about the professional nature of high school mathematics teachers; to enhance teachers' knowledge of mathematics applications; to provide opportunities for professional self-enhancement; to provide opportunities for teacher recognition; and to provide time for teacher interaction, work, and professional development. These goals are envisioned as positive steps toward institutionalization of structures and processes that will foster teacher professionalism and that will be decreasingly reliant on external administration and facilitation.

Collaborative governance is shared among the twenty-nine-member Steering Committee and its Executive Committee, called the "First Tuesday Committee," and the department chairs from each of the twelve high schools. The Steering Committee, comprised of teachers, school district administrators, college and university faculty members, and representatives from various community councils, corporations, and foundations, meets twice annually to discuss the direction and activities of the collaborative. The department chairs meet monthly to plan and evaluate specific activities. The department chairs also serve as the major communication channel between the collaborative and the teachers.

During the 1986-87 school year, the Pittsburgh Mathematics Collaborative offered a wide variety of activities and programs designed to enhance professionalism and collaboration among teachers and professionals in the mathematical sciences, as well as to provide teachers with information about the applications of mathematics. These included receptions, seminars on uses of mathematics in the workplace, computer training, curriculum development which included policies for the use of calculators, and tours of local industries. The collaborative also encouraged teachers to take advantage of professional opportunities provided by related organizations, such as professional conferences, lectures, and professional enrichment grants.

St. Louis Urban Mathematics Collaborative

Director: Ms. Judy Morton
On-Site Observer: Mr. James Richmond (appointed January, 1987)
Funding Agent: Mathematics and Science Education Center
Date of Initial Funding: April 15, 1986

The St. Louis Urban Mathematics Collaborative was one of the four collaboratives established in 1986. The collaborative, which serves the 104 mathematics teachers and 14 computer science teachers in the St. Louis Public School District, is administered through the Mathematics and Science Education Center.

The four primary goals of the collaborative focus on giving teachers the opportunity to explore business-, industry-, and university-based resources to determine how these resources may assist them in their professional growth and classroom instruction; to develop and implement staff training programs for themselves and for their peers; to improve communication and information exchange among mathematics teachers both within and across schools; and to promote recognition of accomplishments and quality performance among all mathematics teachers and students. These goals were derived from the expectation of secondary mathematics teachers that the collaborative would improve communication, collegiality, knowledge of mathematics and its applications, instructional expertise, and feelings of professionalism among the targeted teachers.

Some administrative duties in the collaborative are assumed by a Collaborative Council. During 1986-87, the Council consisted of eight teachers, one university mathematician, two mathematics supervisors from the St. Louis Public Schools, the director of the Partnership Program, and the collaborative director. The Collaborative Council, when fully staffed, will consist of ten teachers from the St. Louis Public Schools, two representatives each from the academic and business communities, three mathematics supervisors and two other administrators from the district, and the collaborative director. The Council meets once each month to discuss, plan, and evaluate collaborative events. Decisions are made by Council vote.

Many of the activities sponsored by the collaborative during the 1986-87 school year focused on gathering teacher input on and generating interest in programs to be offered in the future. Various planning meetings have been held to make teachers aware of the opportunities for professional growth which are available to them. As an initial activity, the collaborative funded teachers to attend a conference designed to increase awareness of linkages between science, mathematics theory and technology. The collaborative also paid teachers during the summer to compile resource lists for distribution throughout the district. Development of the resource guide began in summer 1986 and will continue through summer 1987. Resources that were catalogued included people and organizations; data communications, books and journals; videotapes and films; and computer software. The collaborative also organized summer site visits to area businesses, sponsored grant writing seminars during which mathematics teachers were informed about grants that were available, and funded teachers to go to a variety of seminars.

San Diego Urban Mathematics Collaborative

Director: Prof. Alma Marosz
Coordinators: Mr. Frank Holmes
Ms. Beth Schlesinger
On-Site Observer: Dr. Sharon D. Whitehurst
Funding Agent: San Diego State University Foundation
Date of Initial Funding: April 15, 1986

The San Diego Urban Mathematics Collaborative, established in spring, 1986, is administered through the San Diego State University Foundation. During the 1986-87 school year, the collaborative served sixty-six mathematics teachers from six targeted schools: a senior high school and its two feeder schools in each of the Sweetwater Union High School District and the San Diego Unified School District.

The primary goal of the collaborative is to improve the professional life of mathematics teachers in the San Diego area by reducing the tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community.

The collaborative is governed by a project director, two project coordinators, and the Executive Committee consisting of mathematics specialists from the city and county, teachers who were involved in writing the proposal, and teachers from the targeted schools, as well as a faculty member from San Diego State University and the collaborative director and coordinators. The major thrust of the Executive Committee's efforts currently is directed toward instilling in teachers a sense of project ownership.

In addition to encouraging teachers to take advantage of a wide array of local resources, the collaborative has hosted a wine-and-cheese reception, an evening dinner colloquium and social, summer workshops at San Diego State University, a mini-course in discrete mathematics, a workshop on technology in the classroom, and an evening retreat. The collaborative also has paid the membership dues of the Greater San Diego Mathematics Council for all the mathematics teachers in the six targeted schools and offered stipends to teachers to attend several conferences and workshops, including the fall conference of the Southern Section of the California Math Council, the national NCTM conference and the Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy.

San Francisco Mathematics Collaborative

Executive Director: Ms. Gladys Thacher
Director of Development & Community
Outreach: Ms. Janice E. Toohey
Project Director: Ms. Wandaline Perelli
On-Site Observer: Ms. Joanne Pamperin
Funding Agent: San Francisco Education Fund
Date of Initial Funding: February 1, 1985

The San Francisco Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which serves the 105 mathematics teachers in the San Francisco Unified School District who hold a major, minor, or advanced degree in mathematics, is administered through the San Francisco Education Fund.

The goal of the San Francisco Mathematics Collaborative is to show teachers "how mathematics is imbedded in the world around us, while being sensitive to the needs and interests of the teachers involved in the program." In light of this goal, collaborative efforts focus on developing leadership skills in teachers and department heads through seminars and opportunities to attend conferences; building collegiality among teachers and networks between teachers and other mathematics professionals; and enabling teachers to infuse into their instruction a sense of imbeddedness of mathematics in the real world.

The collaborative's Steering Committee and Teacher Advisory Committee provide input to the project director. The Steering Committee, comprised of the Executive Director of the San Francisco Education Fund, representatives from the Exploratorium, San Francisco State University, the University of San Francisco, San Francisco Community College, San Francisco Unified School District, and the private sector, as well as two members of the collaborative's Teachers' Council, meets monthly to develop and implement policy, to monitor and evaluate activities, and to plan future activities. The Teachers' Council was reorganized during the spring to include six teachers and the project director as an ex-officio member. In addition to these two committees, the Tripartite Council provides the collaborative contact with those from business and higher education.

During the 1986-87 school year, the San Francisco Mathematics Collaborative offered a wide variety of activities that enabled teachers to form networks with their peers and with other professionals, and to increase their awareness of the developing world of mathematics and its applications. The 1986 Summer Institute at the Exploratorium, as well as follow-up sessions, exposed teachers to applications of mathematics in the physical sciences. A series of Dinner Lectures brought teachers together with distinguished professionals in the mathematical sciences and provided an opportunity for collegiality and for bridging the gap between mathematical theory and application in the worlds of commerce, industry and technology. Mini-grants also were made available to teachers for projects designed to enrich students' mathematics education. In spring, 1987, the collaborative sponsored a series of workshops on discrete mathematics.

Twin Cities Urban Mathematics Collaborative

Director: Prof. Harvey B. Keynes
Teacher Coordinator: Ms. Sally Sloan
On-Site Observer: Mrs. Gerry Sell
Funding Agent: School of Mathematics, University of Minnesota-Minneapolis
Date of Initial Funding: February 1, 1985

The Twin Cities Urban Mathematics Collaborative was one of the five original collaboratives established in 1985. The collaborative, which serves about 200 mathematics teachers in the Minneapolis and St. Paul school districts, is administered through the School of Mathematics at the University of Minnesota.

Since its inception, the project has directed its efforts at helping teachers to exercise more control over their professional lives; at providing professional and educational opportunities to teachers; at expanding the involvement of business and industry; at integrating its efforts with those of other mathematics education organizations; and at increasing its visibility, especially within the school district.

The collaborative's director receives input from a Steering Committee and a Teacher Advisory Committee. The Steering Committee, which oversees collaborative activities, is comprised of teachers, mathematics supervisors, representatives from local industries, area universities and colleges, and the Science Museum of Minnesota. The Teacher Advisory Committee is composed of five teachers who participated in one of the collaborative-sponsored Summer Institutes, and the teacher coordinator. The committee serves as an advocate for ideas generated by teachers from both within and outside the committee and acts as a sounding board for the Steering Committee. Two members of the Teacher Advisory Committee also serve on the Steering Committee. The collaborative is in the process of identifying a building representative for each public and private secondary school. This representative would serve as the collaborative's emissary for the teachers in his or her school.

During the 1986-87 school year, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for both junior and senior high school mathematics teachers. These included the 1986 Summer Institute, which focused on problem solving and enrichment topics for the junior high curriculum; an Academic Year Seminar series in conjunction with the NSF Teacher Renewal Project, a series of dinner lectures; and meetings of the Minnesota Mathematics Mobilization. In addition, the collaborative publishes its own newsletter, which is an important networking component of the project. The newsletter is co-edited by the teacher coordinator and the on-site observer.

Technical Assistance Project

Coordinator: Dr. Mark Driscoll
Program Assistant: Ms. Melissa Fox
Technical Assistant: Ms. Grace Kelemanik
Funding Agent: Education Development Center (EDC)
Date of Initial Funding: September 1, 1985

The Technical Assistance Project (TAP) was established in September, 1985, to provide technical support to the Urban Mathematics Collaborative project. The TAP, which is funded through the Education Development Center (EDC), was formed in response to individual collaborative's requests for extra support and increased information. The TAP's staff of three draws on other EDC staff, as well as on resources in the mathematics and education communities.

The Technical Assistance Project focuses its activities on four goals: to provide the collaboratives with a network of resources for information on mathematics and mathematics education; to provide opportunities for collaborative members to participate in national and regional symposia, workshops, and pilot projects; to establish communication networks among the eleven collaboratives; and to provide assistance in solving local problems and identifying local resources.

The Director of the Technical Assistance Project has visited all the collaboratives at least once during the year to gain a better understanding of local issues and needs. EDC resources have been used to disseminate information on a wide range of issues and to identify local human resources. A computer network, established in fall, 1986, facilitates communication among the collaboratives, and a quarterly newsletter helps to disseminate information to the collaboratives. EDC published a brochure that describes the UMC project and lists the names and addresses of the directors of the eleven collaboratives. The TAP was responsible for organizing the annual meeting of collaborative project staffs. In addition, TAP funded teachers from various collaboratives to meet together and sponsored teachers' attendance at national conferences. This year the Technical Assistance Project initiated a meeting of the district mathematics supervisors in cities in which collaboratives are located and also sponsored activities for UMC participants at the NCTM Annual Meeting.

III. OBSERVATIONS AND REFLECTIONS

Our observations and reflections about the eleven urban mathematics collaboratives and the UMC project as a whole are organized under four topics: project development/management, collaboration, professionalism, and mathematics focus. These four topics have been chosen because they represent the major issues that the collaboratives are addressing. Our observations regarding each collaborative, which are included in the Summary Reports appended to the complete report, also are organized under these headings. In this section, activities and developments across collaboratives during the 1986-87 school year will be discussed. Aggregating the information that has been collected site by site provides insight into the project, its richness, and its difficulties. While a review of the evolution of each site reveals distinct differences among them, it is clear that common problems and issues are being addressed by all eleven collaboratives.

The underlying assumption of the Urban Mathematics Collaborative project is that collaboration between high school teachers and other mathematics-using professionals in higher education and in business will enhance the teaching and learning of mathematics in inner-city schools. This enhancement can be viewed as the end product of the project's efforts to reduce the isolation of teachers; to boost professional enthusiasm; and to create an environment conducive to generating new ideas, discriminating among options, and encouraging resourcefulness. From the project's onset, collaboration has been loosely defined as establishing relationships and sponsoring activities between high school mathematics teachers and other mathematics-using professionals.

PROJECT DEVELOPMENT/MANAGEMENT

Associated with the stages of collaboration are the stages of development and changes in management that occur as the projects come into being, grow, and work toward permanence. During the 1986-87 school year, the newer sites devoted their time and energies to defining roles and deciding how best to get the individual projects underway. In general, the older projects have in the past year become more comfortable with their organizational structure and have begun to experience a sense of stability. Consistently across the sites, however, adjustments in organizational or administrative structure have been necessary. In some cases, this adjustment has involved redefining collaborative goals; two collaboratives have expanded their focus to encompass science. In others, it has required a more explicit articulation of committee and administrators' roles. Some collaboratives have changed the membership of their advisory committees or replaced certain members of their administrative staffs; others have found it necessary to increase their staffs in order to accomplish their goals. In some projects, the director or coordinator position has evolved from a directive role into one that implements the directives of a steering committee or teacher council. This common need for adjustment is related to the dynamic nature of collaboratives.

The collaboratives function under a variety of administrative structures, an indication that there are many ways to develop and administer a collaborative. The administrative organization of the sites appears to be influenced by such factors as district size, the individuals assuming leadership roles, and collaborative interaction with existing community resources and structures. The administrative approach taken in Durham, for example, has involved allocating leadership functions clearly between the director and executive director, while in Pittsburgh, the key to successful administration appears to be a small planning group that meets regularly. In Los Angeles, a coordinator with sufficient clerical assistance, who is supported by a director and large advisory committee, has been able to attend to administrative details and encourage the involvement of teachers and other professionals. One director, with committee support, has operated the collaborative in the Twin Cities by hiring qualified individuals part time to perform specific tasks that, in another collaborative, may have been allocated to a coordinator.

Personal contacts, interest, and energy have played important roles in initiating and maintaining the collaboratives. The time required to contact teachers, to arrange for the attendance of business representatives at project activities, and to identify interested university or college faculty frequently has been underestimated. These responsibilities generally have been assigned to the coordinator. In some collaboratives, tensions have arisen as a result of lack of clerical support or assistance. In general, it appears that an administrative aide or some other provision for clerical work is necessary to reduce the burden of paperwork so the coordinator can have sufficient time for the people-to-people work and the planning essential to the collaborative's success.

The administrative requirements imposed on the collaboratives by the Ford Foundation, including writing refunding proposals and raising matching funds, have generally contributed to the progress of the collaboratives, rather than posed an obstacle. The effort of writing a refunding proposal has prompted many of the sites to rethink their organizational structures, to evaluate more carefully the progress that has been made, and to develop a more coherent plan for the future. The mere knowledge that a refunding proposal is due after three years has caused some sites to look ahead and prepare for the task by directing committee discussion to the issue of permanence. Although some administrators who have not engaged in fund raising before have found the Ford Foundation's requirement a real effort, the experience has prompted the collaboratives to approach businesses and industries and to invite their participation in the project. Fund raising activities have resulted in contacts with the business sector that have led to other forms of collaboration. The absence of the need for fund raising, because a collaborative functions under an umbrella organization that takes the responsibility for funding, eliminate one reason for approaching business. In some cases, this may have affected the level of involvement in the collaborative by the business sector.

All eleven collaboratives have established a Steering Committee or Teacher Advisory Council. The success of these committees varies by site. Nonetheless, each collaborative has a committee that has the potential to provide teachers with input in the decision-making process.

By design, various types of funding agents are involved in the project. Five sites are funded through some form of public education fund. Other funding agents include a university, an urban league, a residential public high school for academically gifted students, a mathematics and science center, a university foundation, and a science museum. An unexpected outcome at some sites is that funding agents have assumed different roles because of their relationship to a collaborative. The very nature of collaboration has meant that funding agents are becoming as involved with human resources as they traditionally have been with financial matters. The public education funds, in addition to obtaining and distributing resources, have, for example, cooperated in coordinating activities. The director of the Twin Cities collaborative, which is funded through a university, has become involved in soliciting contributions from local districts and businesses. For the first time, the director of the Cleveland Education Fund is writing a grant proposal to the National Science Foundation. The Memphis Urban League, with the long-range goal of improving the academic performance of black underachievers, has become involved in efforts to improve mathematics education for all Memphis students.

Another reason that funding agents have assumed new roles is that collaborative success depends as much on forming relationships and networks as on acquiring funding and administrative support. Thus, funding agents are being asked to identify and to contact representatives of business and higher education to encourage their participation in collaborative activities. Advisory board members provide valuable advice and opinion, but they also contribute key information about those in their organizations who might be willing to donate time and energy to the collaborative. Where the school district once turned to the funding agent for money, collaboration requires that the two work together, meet with each other, plan, and coordinate schedules.

Nearly all sites have experienced structural changes in committees, boards, or administrative roles. But these changes have been made and the sites are progressing; this progress is evident as the mature sites address more substantive issues related to permanence, teacher decision making, conditions of teaching, and relationship with the school district.

As each collaborative evolves, it develops a unique personality. But the issue of institutionalization is one that must be confronted by all eleven sites, as well as by the Technical Assistance Project as it develops strategies for supporting the projects. The direction taken by the collaboratives in addressing this issue will help to validate current efforts to gain the attention of the community, to involve teachers, and to develop an organizational structure that can support the administrative tasks of collaboration.

COLLABORATION

The UMC project has been in operation since 1985. As the project evolves, so does the meaning of collaboration. A key element of collaboration is forming relationships among individuals; these relationships seem to evolve in stages. The first phase involves eliminating barriers and becoming acquainted. In later stages, significant interactions develop in which individuals gain from the relationship and become bonded to it so that they actively seek its continuation.

All sites have been engaged in generating activities to promote collaboration. Many activities have provided opportunities for teachers to interact and to become better acquainted. Others have focused on developing relationships and team building. Others, particularly those involving mathematicians from business and universities, were designed primarily to relay information to teachers about mathematics and its applications. What varied from one activity to another were the kinds of relationships being encouraged, the interactions that occurred, the groups or sectors involved, and the type of planning that took place prior to the event. While the activity itself is important, the sites are finding that the planning phase can be even more instrumental in promoting collaboration.

It takes a considerable amount of time to form relationships that result in significant interactions from which individuals draw specific benefits. Because the sites are in their formative stages, our observations at this point are based on an incomplete process. It is apparent, however, that the sites have organized a wide range of activities with a variety of results. Our discussion will first focus on teachers and the relationships that have been established both between teachers within a school and between teachers across schools through activities or involvement with the collaborative. We will then address the relationships that are beginning to form between teachers and other mathematics-using professionals.

At this point in the UMC project's development, the most significant relationships formed as a result of collaboration have developed between teachers. Teacher-teacher relationships have been strengthened within schools and across schools within districts.

Within-School Interaction

In their proposals, a number of the sites identified goals that focused on eliminating the barriers that isolated teachers. While each of these sites is striving to establish networking, collegiality, community, and mutual support among teachers, there is a great deal of variation in the level of relationships emerging among mathematics teachers. If one believes that to enhance their professionalism and to network, teachers must feel a sense of group membership, then the mathematics department within a school may be considered a logical place for teachers to begin to share information and to participate in professional activities. There is, however, wide variation in how mathematics departments function across the eleven sites and even within individual districts. In some schools, the mathematics department is little more than a roster of mathematics teachers. Some departments meet weekly, while others do not meet at all. Most departments have very little, if any, sense of power or group identity. The authority of the department head varies across sites, and even within a school district, from delivering mail, as described by one mathematics department head, to having the authority to assign teachers to classes and to participate in faculty selection.

Because departments function so differently, collaboratives have chosen a variety of strategies by which to foster working relationships within them. Some projects have used the department as a foundation for building collaboration, enhancing the teaching of mathematics, and organizing activities. The Los Angeles collaborative, for example, has made a concerted effort to develop in-school teams using the school departments as a base. Its strategy focuses on involving at least 60 percent of the mathematics teachers within a department in writing a grant proposal that is submitted to the +PLUS+ program. As a result, teachers work together to develop and produce an action plan for a specific school year. The collaborative facilitated the process by offering team-building workshops and grant-writing training. As a result, new relationships have begun to emerge among teachers who may have been teaching in neighboring classrooms but had not interacted to any degree. At the end-of-year sharing meeting in June, 1986, +PLUS+ teachers talked about what had been accomplished as a result of the collaborative. One teacher commented, "My department certainly has grown." In one school, teachers within a department began to meet regularly over lunch and to plan other group activities. Becoming acquainted, both professionally and socially, seemed to facilitate other developments, such as increased use of the Geometric Supposer and teachers working together to plan the collaborative-sponsored workshops for other district teachers. The fact that not all department members from this particular school became involved indicates that group cohesion or membership is not as important to some mathematics teachers. Some teachers remained isolated, either by choice or because of other commitments, such as coaching. It should be noted, however, that more mathematics teachers became involved in writing the action plan during the second year of the program, which supports the idea that forming relationships takes time. Having teachers from a department work and plan together has helped teachers view each other in new ways. At the April, 1987, +PLUS+ Proposal Planning Meeting a teacher reported, "My department and I learned some things about ourselves we didn't know. Now that is worth our time."

San Diego also has chosen to focus some of its efforts on local school mathematics departments. In initiating the collaborative, the project coordinators met the department heads of each of the six targeted schools. One department had not met in recent memory; with the help of the collaborative coordinator, a department meeting was held. At this meeting, which was attended by an assistant principal, teachers discussed some problems they had experienced but had not been able to communicate to the school administration. As a result of the meeting, a new relationship was formed between the mathematics teachers and the administrator. As in Los Angeles, mathematics teachers in San Diego have begun to relate to their peers somewhat differently. Impetus from the collaborative has prompted the department to develop from a collection of individual teachers into a functioning unit that can work for the professional benefit of all of its members.

The Philadelphia collaborative faced a very different situation. Departments are required to meet monthly. As a result of collaborative encouragement, some departments in the targeted schools began to apply for and to use grants to support a variety of professional enrichment activities during department meetings, as well as at other times. In one high school, mathematicians from nearby universities led problem-solving workshops during department meeting times. In other schools, teachers received computer training and began to view one another as resources when problems arose. In another school, the mathematics and science departments began to meet together and to develop a relationship that would foster coordination in the teaching of the two content areas. The exact role of the collaborative in creating change in these departments is somewhat cloudy. It is clear that the collaborative provided the personal attention of its coordinator, who monitored the activities and intervened when necessary; this attention certainly was instrumental in initiating the activities and in sustaining them over time. Clear results of the departments' role in the professional development of teachers are difficult to determine. However, the activity itself speaks to the value of encouraging teachers to relate to one another in different ways--solving problems together, discussing problem solving, and helping one another learn more about computers.

The Pittsburgh collaborative has provided teachers the opportunity to share with their colleagues by offering activities in which they can participate together. In the Pittsburgh school district, groups of high schools are assigned the same teacher in-service days. The collaborative took the initiative and scheduled industrial site visits for mathematics teachers on those in-service days; because the in-services were mandatory, all mathematics teachers from the participating schools shared the experience.

Groups of teachers from the same departments in the Twin Cities arranged to attend the Summer Institutes so they could work together during the year on topics discussed in the Institute. As a result, teachers at one high school initiated study groups with their students. The fact that three of the twelve teachers in the department had attended the Institute helped them to implement the new program.

In some collaboratives, mathematics teachers within schools are relating to each other in new ways that can, at least to some degree, be attributed to collaborative involvement. A Philadelphia teacher articulated the problem, "Teachers are so burdened that it is like we are on an assembly line and there is no time to talk." In some cases, new relationships have resulted from teachers working more cohesively as a department or experiencing professional growth together as they learn more about mathematics. In other cases, these new relationships involve sharing a common activity or experience. In many cases, it is clear that teachers who have worked in the same school for a number of years are now beginning to relate to one another in new ways.

Across-School Interactions

Teachers in all eleven collaboratives have expressed their appreciation for opportunities to meet and socialize with their school-district colleagues. At a May, 1987, Triangle Mathematics Club meeting in Durham, a teacher commented, "I often get discouraged--evenings like this cheer me up--I can go back to class and try again." Nearly all collaborative activities--symposiums, workshops, dinner meetings, institutes, site visits, and committee meetings--provide this valuable opportunity for networking and sharing. Prior to these activities, interaction among teachers often was restricted to colleagues in a single school--if it occurred at all. There are, however, several reasons why teachers had not interacted with their peers from other schools. The first involves scale; inner-city school systems in the UMC project, with the exception of Durham, range in size from twelve high schools in Pittsburgh to forty-seven high schools in the Los Angeles area. Typically, only a very few district activities congregate teachers from across schools; these may include, for example, textbook selection committee meetings and district-wide in-service days. Theoretically, while professional organizations may provide the opportunity for teachers to interact, many teachers do not belong to professional organizations, and many who do, do not attend meetings. Teachers' enthusiasm for collaborative events that foster personal interaction suggests that a void in teachers' professional experience existed prior to collaborative involvement.

As a result of collaborative activities, teachers in the eleven sites are forming new relationships or strengthening former relationships with other teachers throughout their district or, in some cases, across districts. Initially, many sites sponsored some form of ice breaker, during which teachers were able to meet and become better acquainted. As the collaboratives evolved and began to develop activities to meet local needs, interaction among teachers depended on individual activities and varied from site to site.

Some sites have made concerted efforts to develop opportunities for teacher networking. In Durham, two networking groups, one focusing on geometry and the other on algebra II/precalculus, allow teachers to review and evaluate new curriculum materials or software. In other sites, networks have been established to share teacher-developed materials. Teachers who participate in the Summer Institute in the Twin Cities provide, on request, the module they prepared and tested with their own students. In Philadelphia, a network is being established for teachers of the Mathematics in Applications course. Materials prepared by teachers will be distributed to all teachers in the network. Memphis is planning swap shops, while Los Angeles anticipates linking teachers through an electronic network. As noted by one Philadelphia teacher at a collaborative evaluation and discussion meeting in May, 1987, "It was good to talk to each other because we don't often have that opportunity. It was nice to learn what is happening in other schools."

The collaboratives are using a variety of approaches to facilitate communication among teachers, and to help teachers keep one another informed of collaborative-sponsored events and other professional activities. Six of the collaboratives send newsletters to all collaborative teachers. Most of these include articles or listings about collaborative- and district-sponsored activities of interest to mathematics teachers, as well as information about grants awarded to mathematics teachers, new ideas about mathematics instruction, and innovative ideas teachers are implementing in their classrooms. Collaboratives without newsletters disseminate information through such means as notices to the department heads or regular mailings. In the Twin Cities, a representative at each high school has been identified who disseminates information as one responsibility.

In addition to these more formal contacts, teachers are forming networks on a personal level with other teachers they have met at collaborative activities. A San Francisco teacher with four years experience, who is teaching calculus for the first time, began networking with a more experienced calculus teacher he met at a collaborative-sponsored Nobel lecture. This type of networking provides a service that is especially valuable to those inner-city teachers who are the only ones in a school who teach a given course, or who, as in San Francisco, are teaching mathematics courses without a major or minor in mathematics.

In Cleveland, teachers developed and continue to run a resource laboratory for all mathematics teachers in the district. Teachers who staff the lab serve as a valuable resource to their colleagues; during the 1986-87 school year, lab resource teachers conducted workshops. The lab staff also makes computers available for teachers' use and offers bulk pricing on such supplies as computer disks. The teacher-directed workshops in Los Angeles and a presentation by teachers to the Mathematics Society in the Twin Cities are other examples of collaborative teachers serving as resources to their peers.

A new relationship has developed among the mathematics teachers who participate in the collaboratives, and between the teachers as a group and their local school district administration. All of the collaboratives operate in the context of a school system that has its own administrators, rules, mandates, and procedures. In many sites, the collaborative is beginning to assume an identity as an organization of mathematics teachers that can take on certain responsibilities and provide a service to the district. In many cases, however, a district's willingness to accept teacher input on important issues has emerged only after prodding by the collaborative. Such was the case in Pittsburgh where, through the efforts of the collaborative coordinator and the district associate director of mathematics, the district superintendent assigned the committee of department heads the responsibility to design the third-year mathematics course. The department heads, who now meet monthly, had been a group in name only prior to their involvement with the collaborative. Monthly meetings and a common purpose has transformed this loosely affiliated group of individuals into a cohesive unit that enjoys its work and provides a vital service to the district. While the opportunity for teacher interaction had great appeal, recognition of a common goal and task fostered a sense of group interdependency and cooperation.

Another form of teacher-to-teacher bonding appears to be developing among teachers who assume representative roles for the collaborative's general membership. Some collaboratives have appointed five or six teachers to an advisory board or council. As advisory board members, these teachers help make decisions that guide and influence the collaborative. As representatives of their peers, they play a key role in providing a teacher's view and perspective and in offering other teachers the opportunity to have their positions voiced.

The Steering Committee in Durham, which includes one teacher from each of the fourteen schools, has developed a strong sense of group identity. Monthly meetings and the group's role as a conduit of information between the collaborative director and the teachers have stimulated interpersonal bonding to the extent that teachers were resistant to a proposal that they resign their positions to allow other teachers the opportunity to serve on the Steering Committee. A similar process occurred in St. Louis, where the Collaborative Council consisted mainly of teachers making decisions about the collaborative's focus and role. What appears to be a common factor among these sites is that a group of teachers meets regularly with an explicit objective or goal to achieve. The influence of a facilitator who helps to convene the group also seems to be important in the beginning.

Across Boundaries

An underlying assumption of the UMC project is that establishing collaborative relationships between school mathematics teachers and other mathematics-using professionals in higher education and business can enhance the professional lives of the teachers and positively affect mathematics education in the schools. All sites, except St. Louis, have representatives of business and higher education serving with teachers on an advisory board or council. St. Louis, at the close of the 1986-87 school year, was working to identify a representative from local business to serve on its collaborative council. While these boards have functioned with varying degrees of effectiveness, in all cases collaboration is occurring among board members as they participate in board business. Members from the various sectors share equal status in decision making, in defining collaborative activities, and in determining the collaborative's role and identity. The advisory board structure also fosters a deeper understanding between secondary teachers and people from business and higher education. In a group discussion in Durham, for example, a business representative voiced his dismay about a young salesclerk who could not make proper change, and a teacher described her frustration with the meager salaries teachers receive.

Inclusion of representatives from various sectors on a board or council does not guarantee positive or productive interaction. In light of this, some collaboratives have successfully organized smaller groups to focus on particular functions, such as planning workshops or scheduling site visits. Identification of a specific task or goal seems to generate more interaction and involvement from committee members.

Another form of collaboration occurs when a business or university representative serves as a resource. All eleven sites have involved people from higher education and business in this way. In the Twin Cities, for example, a business executive was invited to speak to teachers on industry's use of computer programming. In Memphis, a professor from Rhodes College gave a presentation on discrete mathematics at the collaborative's kick-off dinner. Some collaboratives have arranged for teachers to visit businesses and industries. These site visits provide teachers with resources for mathematical applications, but sometimes go beyond this to provide teachers with a feeling of being a part of a larger mathematics-using community. After a site-visit to Shell Offshore, a New Orleans teacher commented on the Shell Offshore staff, "They provided a more peer-type relationship rather than one that was superior."

It should also be noted that teachers at some sites are serving as resources to others in the community. The most vivid example of how teachers' expertise and experience can benefit those with whom they collaborate involves the Exploratorium in San Francisco. Teachers who worked closely with the Exploratorium staff during the Summer Institutes were asked to develop modules to explain the mathematics related to several exhibits. As a result, the exhibits became more of a guided learning experience rather than a simple exposure to physical phenomena.

The UMC project is striving to bring teachers and representatives of business and higher education together to improve and enhance both the professional lives of the teachers and mathematics education in the schools. The results of these efforts are beginning to emerge in several of the more established collaboratives, where representatives from all three sectors are working together to accomplish a common task or goal. In this interactive collaboration, teachers, business people, and university representatives share equal status, each contributing valuable viewpoints and expertise in order to solve a problem or to plan an activity. In Los Angeles, for example, teams are organized to plan and conduct workshops. One such team brought together an engineer from Hughes, an astrochemist from the California Institute of Technology, and a high school mathematics teacher to plan and present a workshop for teachers on exponential functions.

At this stage in the development of the project, it appears that collaboration assumes a variety of forms. Significant interaction among people has not occurred spontaneously; careful planning and program development have been prerequisites to collaborative success. Important relationships are forming among teachers--within schools, across schools, and even across sites. Relationships that involve teachers, business associates, and higher education representatives are more difficult to establish and require more time and effort. What has become clear at all eleven sites, however, is that representatives of the three sectors are becoming acquainted, teachers are becoming more knowledgeable about mathematics and its applications, and all are coming to understand their counterparts' working conditions. After a summer internship with a finance company, a Memphis teacher reported, "I learned that I could do something other than teach. It was a challenge. I learned that teachers are more confined, work harder, and aren't really treated as professionals." As the sites develop toward permanence, it will be important to note how these relationships evolve.

PROFESSIONALISM

A general picture is emerging of mathematics teachers in inner-city schools and how they view themselves as professionals. Since observations still are being made and convergent information is being sought, the picture is incomplete. Teacher interviews and questionnaire responses collected to date, however, provide an initial outline of teachers' perceptions of their profession and their own role in it.

Teachers in inner-city schools face limited budgets, a scarcity of resources, large classes, complex bureaucratic school systems, few opportunities for professional activities or enrichment, and high percentages of at-risk students. It appears that the collaboratives are beginning to provide these teachers with a sense of self-identification with a professional group that includes teachers, as well as mathematicians from businesses and universities. But the question remains about what impacts have been made or will be made on other aspects of the professional lives of teachers. Whether collaborative involvement will encourage teachers to assume the responsibility and demand the right to make significant decisions related to their work, and to the teaching profession in general, and whether teachers will develop a sense that they are providing a needed and valued service to society remains to be seen. The duration and design of the UMC project provides a rich opportunity for teachers to enhance their professional lives and for observers to note and to learn from the process.

The Documentation Project administered a survey on professionalism between May, 1986, and August, 1987, to teachers in nine of the eleven sites. The survey was a self-report of attitudes about teaching as a profession. Additional information about teachers' sense of professionalism was obtained through interviews; each month all eleven on-site observers queried five teachers to maintain a diary of professional relationships. Results of the survey suggest that teachers in nine of the sites believe that what they are doing is important to society. More teachers agreed than disagreed that others appreciate what they do. Teachers cited as reasons for their choice to teach mathematics both their liking of mathematics and their wish to work with youth; more teachers identified liking mathematics than their desire to work with young people.

Most mathematics teachers indicated that they feel comfortable talking with mathematicians from universities and businesses, and that they feel they have important contributions to make in such discussions. Only 13 percent of teachers reported feeling "out of place" in such conversations. Teachers also seem to feel that they have a lot to learn from one another. When interviewed about whether they would benefit most from meetings with other teachers or with other professionals from business or universities, more than half of the teachers responded that they would gain the most from meetings with other high school mathematics teachers.

The mathematics teachers were more mixed in their responses when asked about making curriculum decisions. Not only did differences emerge among teachers at a given site, but clear differences in mean responses were identified across sites. The eleven sites vary a great deal in terms of who makes the decisions on curriculum. When teachers were interviewed about who made overall decisions about the objectives of mathematics courses, they gave a range of responses. Some reported that decisions were made by a district committee of teachers and the district mathematics supervisor. Others reported that teachers alone made the decisions. Still others indicated that the mathematics department, the district, the state, or textbook authors were responsible for curriculum decisions. Variation in the responses of teachers from a single site indicates that either curriculum decisions vary within a site or teachers have different perceptions about who is making decisions. When asked who should make these decisions, teachers most often agreed with the current practice as they perceived it. They were in strong agreement that teachers do and should make decisions on daily activities, lessons, and materials.

Results of both the survey and the personal interviews indicate that teachers do not agree that final decisions on curriculum should be theirs alone; in fact, more teachers indicated that the decision should not be their responsibility. This position supports the view that education falls within the domain of a number of different people, all of whom need to have input.

Teachers' perceptions about the level of control they exert vary across sites and do not always support that which local conditions would indicate. Durham teachers had a higher mean agreement with the statement that mathematics teachers have the control they should have and have an opportunity to exercise their own judgments. This is surprising in light of the control exerted by the state in selecting textbooks, defining salaries, and applying the Teacher Effectiveness Model. Teachers in Pittsburgh, on the other hand, varied in their responses and had one of the lowest mean agreements among the sites on questions related to autonomy in decision making. The school districts in both Pittsburgh and Durham are implementing a form of the Teacher Effectiveness Model. While in both sites, control of the teaching in classrooms is being imposed by a higher authority, teacher opinion noticeably differs between the sites.

Responses to questions about who should evaluate mathematics teachers also varied significantly across sites. Cleveland mathematics teachers had the highest mean agreement to the statement that mathematics teachers should be evaluated only by other mathematics teachers. In Cleveland, the task of evaluating teachers belongs to the principal, with apparently little input from teachers in the development of the evaluation procedures. Teachers from San Diego were split on the question of whether mathematics teachers should be evaluated only by mathematics teachers. As in Cleveland, it appears that the principal evaluates teachers in San Diego. However, at least some of the teachers who were interviewed acknowledged that teachers had some input in the evaluation, either through contract negotiations or through submission of goals and objectives on which teachers were to be evaluated. Having some teachers input seems to defuse the need for teachers to be evaluated by other teachers.

Consistently across all nine sites, teachers who were identified as having a high level of collaborative participation responded more positively on the survey's professional organization scale than did other teachers. The collaboratives' active teachers also reported feeling more comfortable talking with university and business mathematicians, and more often expressed the view that professional organizations should have a role in reforms in school mathematics.

It appears that the collaboratives already are beginning to impact on the professionalism of teachers in the eleven targeted sites. Review of collaborative activities across sites reveals that the projects have generated a wide spectrum of professional activities unavailable prior to their existence. In St. Louis, where there are few incentives for engaging in professional activities and district mandates create a restrictive atmosphere, teachers who have been involved in the collaborative feel that their participation has given them the opportunity to be treated as professionals. In the Twin Cities, a Mathematics Society has been established. In Durham, the Triangle Mathematics Club offers teachers enrichment opportunities. In Los Angeles, +PLUS+ workshops bring teachers together to learn and to share. Some teachers are challenging traditions within their districts on such fundamental issues as who selects the textbook and who develops the schedule. These changes occur when individual teachers, motivated by both their involvement in the collaborative and the support they get from each other, take the initiative to challenge the status quo.

MATHEMATICS FOCUS

The eleven sites vary on the emphases they have given to specific mathematics topics. Where a group or person is available to provide clear leadership in a specific area of mathematics, the site has a more explicit definition of the mathematics it stresses and the direction it is taking to affect what mathematics students learn. In Cleveland, where the district mathematics supervisor is very involved with the collaborative, a clear focus on problem solving has emerged, with an emphasis on integrating problem solving into the mathematics curriculum. In Pittsburgh, where the district's associate director for mathematics is a member of the collaborative's decision-making group, the mathematics focus is an extension of district initiatives; these have included integrating calculators and computers into the curriculum and encouraging teacher involvement in selecting the Algebra I textbook. In the Twin Cities, where there is strong involvement of university and college mathematicians in the governance of the collaborative, the focus is on problem solving; Summer Institutes are directed at helping teachers become better problem solvers.

Other collaboratives have depended heavily on teachers and teacher committees for input on the areas of mathematics that should be stressed in project activities. In these sites, the mathematics focus has included a variety of topics rather than centering on a specific theme. Durham, influenced by the teacher Steering Committee, has developed networks for teachers of algebra, precalculus, and geometry to provide an opportunity for colleagues teaching the same course to interact. In Los Angeles, department teachers have defined the direction to be taken by their group. Teams of teachers and business and university associates have planned workshops focusing on applications of mathematics and such topics as discrete mathematics.

Across sites, some general directions and issues are emerging as the collaboratives develop and work with the Technical Assistance Project. Equity in the classroom, an issue which involves differentiation in classes taken by particular groups of students, is clearly a concern at many sites. Problem solving has been, and will continue to be, an important mathematics focus across sites; in some instances, the collaborative has begun to influence the district curriculum and the ways in which teachers present mathematics as problem solving. A third issue focuses on technology in the classroom. In Philadelphia, for example, the collaborative is actively involved in working with teachers to help them use computers in the newly developed third-year mathematics course, Applications in Mathematics. All sites have included, to some extent, real-world applications of mathematics by inviting users of mathematics to make presentations or by including the issue as a key Summer Institute topic. In San Francisco, the Exploratorium worked with teachers to define the mathematics applicable to several exhibits. Another mathematics focus adopted by many of the sites involves the need for inclusion in the mathematics curriculum of more discrete mathematics, probability, and statistics. Many sites, such as St. Louis and Memphis, have invited speakers on discrete mathematics to address groups of teachers. A final mathematics focus of concern to a number of the sites involves increasing the effectiveness of efforts to make needed changes in the teaching of the traditional mathematics courses of Algebra and Geometry. Impetus for such improvements has resulted from increases in graduation requirements at many sites, including New Orleans, where students must complete Algebra 1, Geometry, and Algebra 2 for graduation.

The collaboratives have provided teachers with an impressive array of activities that have the potential of shaping the curriculum in ways identified by national organizations for reform of the mathematics curriculum. It is the role of the Technical

Assistance Project to apprise key people at each of the sites of the latest reforms. Collaborative teachers' increased awareness of current developments in mathematics education, locally and nationally, is a clear outcome of the UMC project. This new awareness has been developed through a variety of means, including workshops, institutes, newsletters, symposiums, and presentations. At this stage of project development, it is difficult to identify how teachers are responding to the many activities and whether their expanded awareness has impacted on the curriculum. Only a few of the sites have developed a clear vision and a definite strategy for taking advantage of teachers' increased knowledge of mathematics to affect the curriculum. In some collaborative sites, a weak link between the collaborative and the local school district makes it premature to even entertain such a vision.

Overall, a strong mathematics focus, which addresses issues of what it means to know mathematics and what mathematics should be included in the curriculum, has not evolved in the collaboratives. In most sites, collaborative efforts involving mathematics have been directed at creating topics for discussion or reasons for bringing people together rather than at creating a focus for curriculum change. Through project activities, however, teachers and others are becoming more aware of trends in mathematics education, needed change in emphases for the secondary mathematics curriculum, and applications of mathematics. But only the awareness stage has been reached, with most sites only on the edge of the current mathematics education reform movement. Some collaboratives have made more progress than others in assuming a strong mathematics focus. These are collaboratives that benefit from having someone with a strong mathematics background or interest in curriculum change who is actively involved in the collaborative. Collaboratives that are funded through a mathematics or mathematics education agency or that have the active involvement of the district mathematics supervisor generally have made more progress toward having a mathematics focus than the others.

True collaboration will result in teachers working with one another and with the larger mathematics education community toward lasting change in their own school systems and in the mathematics curriculum. Today, instances of collaborative impact are easily identified. At some sites, teachers are using the Geometric Supposer with skill and confidence, while at others, they are devoting new energy and effort to teaching their students problem solving. But significant change that raises the mathematical knowledge of large numbers of students to better prepare them to meet the challenges of the future will require true collaboration among teachers, district administrators, and other professional users of mathematics. The groundwork has been laid. The sites must now establish permanent structures that will wield a lasting influence on teachers, students, and the mathematics curriculum.

IV. FINAL COMMENTS

As the UMC project continues into its third year, a brief review of its progress reveals a series of significant successes that, taken together, form the foundation of a far-reaching network of new energy and enthusiasm for mathematics education in our nation's inner-city secondary schools.

Collaboration is catching. Participants in the Urban Mathematics Collaborative enterprise, from all sites and all supporting groups, have experienced a growing sense of community. Bureaucratic and institutionalized barriers are being removed. People are planning and working together. And things are happening. Through the energy and effort of individuals who are concerned and committed to education, changes are being made in the professional lives of teachers and in the educational experiences of their students. The project continues to be exciting, enriching, and challenging for the participating teachers, for the staff of each project, for the Technical Assistance Project, and for the staff of the Documentation Project.

Tensions in sites have existed as the collaboratives mature and gain strength through the relationships being formed. Collaboratives function within a context that is complex and influenced by many forces. Existing conditions, district policies, or state mandates are sometimes in direct conflict with the collaborative goals or operations. Progress is being made in removing some of these barriers by increasing the involvement of district administrators in collaborative planning or having the collaborative gain an identity as a force that can challenge existing practices. Having some district administration involvement, whether by a district mathematics supervisor or some other administrator, in collaborative decision making and planning helps to remove existing barriers between the collaborative and the district. When these people have not been as involved, problems have occurred.

The length and breadth of this report is testimony to the many activities that have been generated through the UMC project. In the more mature sites, a critical core of committed participants is forming and beginning to have an impact. At the newer sites, the collaboratives are gaining community recognition and making needed adjustments in their management and organizational structures. The Technical Assistance Project has fostered networking among the sites and has apprised the collaboratives of current developments and activities in mathematics education. A significant change in the past year involved the emergence of a national identity and a growing recognition of the UMC project's existence, efforts, and goals. People have begun to approach the TAP, the Documentation Project, and the Ford Foundation to work with or to become a part of the project. Those interested in teacher renewal and curriculum reform are beginning to recognize the potential of the UMC project for creating positive changes in the mathematics education of the nation's inner-city youth.

Four general remarks should be made about the project as a whole, and about the process of documentation. First, the impact of a broadly based support network provided by the UMC project cannot be discounted in interpreting the development of the individual collaboratives. The Ford Foundation project monitor, Barbara Scott Nelson, and the staffs of the Technical Assistance Project and the Documentation Project have each contributed to and collaborated with all of the sites. The Ford Foundation's requirement that the collaboratives seek matching funds and become financially independent has provided an opportunity for the sites to evolve, to adjust as needed, and to initiate new activities; at the same time, it has encouraged them to look ahead, to develop community networks, and to concentrate on long-term planning. Dr. Nelson's ability to communicate with the sites and to foster their progress and development has provided encouragement and insight on a wide variety of occasions. As a representative of the prestigious Ford Foundation, Dr. Nelson offers the collaboratives public visibility and the political clout that can open school district doors or bring large numbers of new participants to a gathering or reception.

The Technical Assistance Project has sponsored activities for the collaboratives, has fostered networking among the sites, has convened meetings of key site representatives, has kept the sites informed of the status and direction of mathematics curriculum reform, and has acted behind the scenes to address problems at individual sites.

The Documentation Project provides each of the collaboratives with a broader view of its place in the overall UMC project. It offers an objective but attentive audience, with information and comments on how other sites are dealing with similar issues, and advice on problems common to all sites. The staff also provides professional expertise in mathematics education when such input is requested. In many sites, the on-site observer has assumed a leadership role that surpasses that of a reporter or recorder of events.

The eleven collaboratives do not operate in isolation, but depend on a support network that is both influential and valuable. In generalizing the concept of collaboration and in suggesting to other cities how they may develop their own collaboratives, the existence and role of the support network is a critical consideration. An important question is whether the existence of such a broadly based support network is essential to collaborative success.

A second issue that merits consideration involves change, reform, and the enhancement of the teaching profession. As we document collaborative development and progress, with special attention to the process of change, it is essential to understand the social and political contexts in which each site operates, and the level of effective leadership available in each collaborative community. The impact of an individual school district, economy, community, funding agency or set of traditions on the nature and success of each site cannot be overestimated. As evidenced by the wide array of successful events and widespread progress described in this report, collaboration takes many forms; individual sites have managed to draw on the unique strengths and experiences of their own leadership to make change happen.

To date, that change has largely occurred at an individual level. As a result of their collaborative participation, a number of teachers at each site appear to view their profession differently. Certain teachers have changed the mathematics they teach and the methods they use. Others feel a part of a larger group of mathematicians. Some mathematics departments are now working as cohesive units rather than as individuals to achieve their goals. Nonetheless, change at a district-wide level is difficult to detect. It is possible that the collaboratives will affect most significantly the professional lives of individual teachers. It may be that two years is too short a time for system-wide changes to emerge. Or, it could be that significant change occurs in small increments that accumulate over time. The duration of the UMC project and the ongoing documentation of its development will provide insights into the process of change. The data and observations collected during the project's first two years form a rich base of information about the context, individuals, and activities of the collaboratives. As the more experienced sites begin addressing issues of permanence, this data base will enable us to detect changes in individuals, in the curriculum, and in the system.

A third topic of concern focuses on documentation and how our view of the process has changed since 1985. Initially, documentation was viewed as monitoring and reflecting on site developments. Data and information were collected as the basis of inferences about collaboration and its effect on the profession of teaching. In the process of collecting information and writing reports, however, the Documentation Project's role has become increasingly interactive. Documenters on site visits frequently answer questions or clarify issues in discussions with teachers or collaborative staff. Simple objective documentation, without such interaction, runs the risk of neglecting a valuable opportunity to learn more about collaborative development and participants' views of it. As we interact with each site, it is essential that we achieve a balance between sharing information as a means of garnering sharper insights into the collaborative's problems and progress, on the one hand, and offering solutions and opinions based on our broader knowledge of the experiences of all eleven sites, on the other.

Interaction is of particular importance in writing the summary reports for each site. At times, we were short of information or made observations that conflicted with those of site participants. Reviewing the report with the project directors and coordinators fosters new insights, provides more extensive information, and sometimes enables the documenters to offer a different perspective to collaborative staff.

Key to the success of the documentation effort has been the work of the on-site observers. In seeking out people to interview, attending activities and meetings, and responding to our requests for information, the on-site observers provide an essential record of collaborative events and administrative processes. Isolated instances in which an on-site observer has been unable to serve this function highlighted the invaluable nature of this informational link between the collaborative sites and those responsible for charting their development.

During the documentation process, an effort is being made to gather information from as many sources as possible in order to achieve a broad perspective. The professionalism survey provides information about teachers as a group, while the teacher interviews conducted by the on-site observers help to validate the information from the survey and provide a more extensive explanation of survey results. The site visits offer the opportunity to talk with teachers and to probe particular issues, including how teachers view themselves as professionals. Individual case studies that will be conducted during 1988 will add to our pool of information by revealing the impact of the collaborative on individual teachers or specific events.

Finally, discussion of the impact of the UMC project must also include mention of the project's effect on the staff of the Documentation Project. After more than two years of observing the ways in which cooperative effort can produce unexpected successes, we have begun to incorporate the collaborative concept into other aspects of our professional lives. Just as vital to our own sense of professional enrichment has been the increasing respect and personal interest we have developed for each of the eleven collaboratives and the people who are working so hard to make them succeed. All of the documenters have taught and have been professionally committed to work in education for a number of years. But involvement in the UMC project has provided a new perspective on what it means to be a teacher in an inner-city school, and a new awareness of the number of very committed professionals who are teaching there. Many are working under less-than-desirable conditions--low pay, long hours, large absentee rates, students with a wide variety of social problems. And yet, when asked why they teach, these teachers inevitably respond that they like working with their students and would not want to do anything else. Asked why he was teaching, one teacher replied, "Nobody ever asked me that before. I guess it is because, while in school, the adults I most admired were my mathematics teachers."

Collaboration is working. The progress achieved since the project inception in 1985 suggests the possibilities; continued efforts and expanded networks in the months to come can be expected to further enhance the professional lives of inner-city mathematics teachers, to enrich the mathematics education of their students, and to provide a role model to other cities. The effects of the spirit of collaboration are extraordinary.

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APPENDIXES

SUMMARY REPORTS FOR THE ELEVEN URBAN MATHEMATICS COLLABORATIVES
AND FOR
THE TECHNICAL ASSISTANCE PROJECT

A. Cleveland Collaborative for Mathematics Education (C^{2}ME)
B. Durham Collaborative: The Durham Mathematics Council
C. Los Angeles Urban Mathematics/Science Collaborative (LAUM/MC)
D. Memphis Urban Mathematics Collaborative
E. New Orleans Mathematics Collaborative (NOMC)
F. Philadelphia Math Science Collaborative
G. Pittsburgh Mathematics Collaborative
H. St. Louis Urban Mathematics Collaborative
I. San Diego Urban Mathematics Collaborative
J. San Francisco Mathematics Collaborative
K. Twin Cities Urban Mathematics Collaborative
L. Technical Assistance Project (TAP)

The following reports are brief summaries of each of the eleven urban mathematics collaboratives funded by the Ford Foundation as well as of the Technical Assistance Project. Although the reports were prepared by staff of the Documentation Project, the content of each report was approved by the project.

SUMMARY REPORT: CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION (C^2ME)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Cleveland Collaborative for Mathematics Education during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Cleveland Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM conference in April, 1987, in Anaheim, California; survey data provided by teachers; and five site visits by the staff of the Documentation Project.

CLEVELAND COLLABORATIVE FOR MATHEMATICS EDUCATION (C^2ME)

A. Purpose

The purpose of the Cleveland Collaborative for Mathematics Education as stated in its proposal for continued funding is:

1. to provide professional enrichment opportunities for teachers;
2. to provide opportunities for teachers to increase their understanding of mathematics and its current applications; and
3. to facilitate sharing, communication, networking, and collegiality among teachers and mathematicians from business, industry, and higher education.

To accomplish these goals, C^2ME has developed a four-year work plan in cooperation with the Cleveland Public Schools and participating teachers. The plan specifies participants and outlines activities designed to enhance the collaborative's efforts to advance and reform the secondary school mathematics curriculum of the Cleveland Public Schools.

B. Context

Several factors impacted on the educational environment in which C^2ME operated during the 1986-87 school year. Four in particular affected collaborative development.

First, in June, 1986, Superintendent of Schools Ronald Boyd was asked to resign due to his lack of leadership in a tense and difficult political environment. In August, Alfred D. Tutela was named the new superintendent. Tutela had served as interim superintendent after the death of Fred Holiday in 1985. Mr. Tutela, who has a reputation for being bright and tough, has been in the school district for seven years.

Superintendent Tutela has exhibited support of the collaborative by attending one of its events. He acknowledged the dedication of those involved, and indicated that he was willing to listen to ideas and suggestions from C^2ME without conceding his full agreement on all points. Superintendent Tutela has been quick to articulate his initiatives and priorities, which include an early retirement buyout for 400 teachers, introduction of the "Scholarship in Escrow" program, and the need to repair buildings and plants.

The early buyout program for teacher retirement would open the door to employment of new teachers and, it is argued, would save money in the longer term. The Board of Education has approved 414 buyouts, representing the retirement of teachers with an accumulated 12,000 years of experience.

The Scholarship-in-Escrow program is a student incentive program supported by the school board. The cost of part of the superintendent's plan for the five-year program will be $2 million per year. Students in grades 7-12 will be paid for receiving good grades on their report cards: $40 for each A, $20 for each B, and $10 for each C. The money will be held in an accumulating fund to assist students in the payment of college fees. The program focuses on the student rather than on the teacher: if the student works harder, or better, the educational problem will be solved. While such a strategy may contribute to a solution, there is some concern that this approach overlooks the role of teachers. Additionally, teachers are concerned that paying for good grades will put pressure on teachers to inflate grades. The Scholarship-in-Escrow program is part of a comprehensive policy to deal with the high dropout rates in the district, currently 44 percent for white students, 38 percent for Hispanic students and 34 percent for black students. It is believed that local employment will shift, with mechanization replacing unskilled workers, so that by 1990, 75 percent of local jobs will require post high school training.

Many buildings are in poor repair due to age, faulty construction, and asbestos usage. Capital improvements to 135 facilities will cost $60 million over the next five years. The district budget faces a projected deficit due to cuts in both local property tax revenues and in state funding allocations. To offset this decline in income, Superintendent Tutela has proposed an operating levy of 8 mills, and a bond issue of $60 million. The levy, which has the strong support of the mayor, will be voted upon in August. The school board and the teachers' union support the levy and bond issue, as well as the capital improvements. The city council is divided on the issue.

Public reaction to Superintendent Tutela's performance has been positive; he has been credited with making progress with court-ordered desegregation, establishing a labor truce in the district, dealing effectively with the transportation problems which have accompanied busing, and having a stronger professional rapport with the school board than did several previous superintendents. A sampling of comments from school observers indicates that the district is much improved a year after Tutela was hired by a unanimous school board.

A second factor that impacted on the collaborative was the adoption of the middle school concept by the Cleveland Public Schools in September, 1986, which resulted in moving the ninth grade into the high school. Based on seniority, mathematics teachers were offered the opportunity to stay at the middle school or to move to the new high school program. As a result of this upheaval, many mathematics teachers were teaching mathematics courses they had never taught or had not taught in many years. The need for teacher in-service became apparent.

Third, in May, 1986, it was announced that each of the twelve comprehensive high schools in Cleveland would participate in an effort to win a "Magnet School Assistance Grant" from the federal government. Each school could qualify to receive up to $20,000 for such purposes as teacher in-service, personnel costs, and teacher and student supplies. Grant requests were required to relate to specific themes that were developed by teacher teams at each high school, with at least one of the themes related to mathematics. Ultimately, the district's grant proposal was rejected by the federal government, but many positive activities occurred during the 1986-87 school year as a result of the competition.

Fourth, in December, 1986, the Cleveland Education Fund received a three-year grant from the Carnegie Corporation of New York to establish the Cleveland Science Collaborative. Joe Flynn was hired to be the full-time coordinator at the science collaborative.

The organization of the district itself has impacted on the collaborative's development, affecting its relationships with district personnel and with the staff in individual buildings. First, the district is largely decentralized, with expenditures controlled by principals. Curriculum supervisors submit suggested lists of equipment for purchase to principals but do so without budgets. Principals work within their individual budgets and establish their own priorities, with input from teams of teachers. Thus the collaborative must, to a large degree, depend on good will at the school building administrative level. If, for example, the collaborative were to produce sets of curriculum materials, the decision to purchase them would rest with school principals rather than with the central administration. Second, the union contract stipulates that teachers cannot be required to attend training sessions and must be paid for any sessions they choose to attend.

C. Development of the Collaborative

The proposal for refunding C^2ME, which was submitted in May, 1986, and funded as of September 1, 1986, reflected the initial success of the project's activities and the favorable response they received from teachers. The proposal discussed building upon these successful activities; no major restructuring or redirection of the project was proposed, nor did any seem warranted.

Paula C. Fay continues to direct the collaborative project. Harriet Jakob, the project coordinator, resigned in June, 1986, to attend medical school. She was temporarily replaced by Bryan Powers, who had taken early retirement from the district after having been a secondary science teacher consultant for several years. In December, 1986, Suzanne Haggerty was hired to assume the coordinator's position. Ms. Haggerty is a senior at Oberlin College, with a major in mathematics and a minor in computer science. Robert Seitz, a mathematics teacher in the Cleveland High Schools, is the on-site observer and the editor of the collaborative newsletter.

During 1986, the U.S. Department of Defense and Aetna Insurance Foundation were identified as sources of collaborative support. In October, 1986, Aetna representatives joined the C^2ME Advisory Board and awarded the collaborative a $22,000 grant. The Department of Defense committed itself in January, 1987, to helping the collaborative identify written mathematics resource materials. In addition, the DOD offered to arrange a visit to defense facilities for Cleveland mathematics teachers to receive training on the mathematics background needed by graduates in order to take advantage of military career opportunities.

Advisory Board

A thirty-two member Advisory Board oversees the operation of C^2ME. Members of the Advisory Board include scientists; engineers; mathematicians; educators (secondary and post-secondary); and professionals in finance, accounting, and applied mathematics (product design and technological advancement). Seven Cleveland Public Schools mathematics teachers and the Cleveland Public Schools supervisor of mathematics also serve on the board. A local professional society (The Greater Cleveland Council of Teachers of Mathematics) and another educational project (EQUALS) also are represented. The flexibility of the board structure permits and encourages the addition of new members as needed; new members are accepted by the consensus of present members. All Advisory Board members serve three-year terms, and successive board or committee terms are allowed.

The Advisory Board met four times during the 1986-87 school year, in September, December, February and May. At the December meeting, four new members to the Advisory Board were welcomed. They included one member from the Department of Defense, two from Aetna Life Insurance, and a professor from Kent State University. In May, 1987, it was announced that the president of Richard Fleischman Architects had joined the Advisory Board.

Teacher Advisory Board (TAB)

A Teacher Advisory Board, composed of eleven teachers, was established in January, 1986, to discuss the needs and goals of Cleveland's secondary school mathematics teachers and to develop short- and long-range plans for C^2ME activities. Members of the Teacher Advisory Board were selected by C^2ME, in consultation with the Cleveland Public Schools supervisor of mathematics, based on their pattern of participation in C^2ME's programs and on their dedication to excellence in mathematics education in the Cleveland Public Schools. Richard Wittman, a mathematics teacher at an intermediate school, volunteered to act as spokesperson for the Teacher Advisory Board; he described the board as having some "real movers and shakers." The Teacher Advisory Board met once during the 1986-87 school year to discuss future activities of C^2ME.

D. Relationship with Other Local Initiatives

In contrast to some of the other collaborative sites, there were very few projects in Cleveland for teachers when C^2ME was funded in 1985. Thus, it had no competitors for teachers' time and attention. This situation, however, may change as a result of the establishment of the science collaborative.

Three proposals were funded during 1986-87 by the Ohio Board of Regents; when combined, these grants will provide more than $140,000 for programs geared to mathematics and science teachers. The proposals were written by other agencies to support the goals of the collaborative and will be funded directly through the college and university. The first proposal, submitted by Cuyahoga Community College, is directed towards both mathematics and science teachers.

The second proposal, submitted by Baldwin-Wallace College, is designed to provide help to underprepared seventh- and eighth-grade mathematics teachers in the areas of problem solving, technology and content. A retirement buyout, effective in June, 1987, coupled with a critical teacher shortage in mathematics nationwide, assures that most teachers of intermediate school mathematics in Cleveland public and private schools during the 1987-88 school year will be underprepared. These teachers will hold valid K-8 certificates, which require between zero and three lower-division college-level mathematics courses.

The third proposal, submitted by Cleveland State University, provides a $76,000 grant to support two three-week courses during the summer of 1987, one in algebra and one in analysis. Teachers will receive four graduate credit hours upon successful completion of this training. While the collaborative was a prime mover in planning the courses, only two of the forty teachers involved were from the Cleveland School District. Because the courses were scheduled during the summer, they were in direct competition with a number of collaborative activities.

Other professional development opportunities and incentives are offered to the Cleveland Public Schools mathematics teachers by local colleges. The collaborative has cooperated with Oberlin College to offer teachers workshops on problem solving, as well as other special programs. In addition, Oberlin Teachers Academy has granted a set of full-tuition scholarships to mathematics teachers. Lorain County Community College conducted a four-seminar series in Advanced Technologies for mathematics teachers.

The Cleveland collaborative has served as a catalyst to teacher involvement in activities offered by other local agencies. For example, after the Teacher Advisory Board suggested a consumer mathematics course last year, the school district organized a committee of five teachers to work during the summer of 1986 to develop a curriculum that would replace shop mathematics and senior mathematics in the schools. The course emphasizes real-life applications and computer usage and will be taught in grades 10-12 with general mathematics as a prerequisite. The formation of this committee under the leadership of Bill Bauer, the district's mathematics supervisor, is an example of the interactive relationship between the collaborative and the school district. Furthermore, the collaborative has helped to identify materials for the new course, including a videotape series. Most of the tapes will be obtained from the Public Broadcasting System through a joint effort of the collaborative and the school system, but some local production also is planned. Curriculum development for the consumer mathematics course was aided substantially by the business and industry contacts established through the collaborative. C^{2}ME also purchased a one-year newspaper subscription for all classes of consumer math.

The MathCounts contest, now in its fifth year, is another example of the collaborative's role as a catalyst. MathCounts, a combination coaching and competition program, is designed to address the problem of declining math skills among students at the precollege level. Students compete in both written and oral matches on such topics as probability and statistics, linear algebra, and polynomials. The program is funded in the State of Ohio by Standard Oil, and sponsored by NASA, NCTM, National Society of Professional Engineers, CNA Insurance Companies, and the U.S. Department of Education. Judges for the contest are supplied by John Carroll University and Baldwin-Wallace College. In 1986, the Cleveland School District had two teams entered with collaborative support. In 1987, the number of participating teams increased to fifteen.

The EQUALS program in Cleveland is offering a 30-hour in-service program aimed at attracting and retaining females and minorities in mathematics. EQUALS, which is affiliated with a national project, is locally sponsored by the Greater Cleveland Educational Center. It receives funding from a number of sources, including the Cleveland Foundation. In the collaborative budget, $1,000 was allocated to contribute to EQUALS' "Close The Lid Boxes" project, which is aimed at producing manipulative materials. To date, this money has not been used.

In November, Bill Bauer, the mathematics supervisor for the Cleveland School District; Bob Seitz, a high school mathematics teacher and the collaborative's on-site observer; and Dick Little, the chair of the Advisory Board, attended a Yale conference on educational collaboratives. Fred M. Hechinger, the president of the New York Times Co. Foundation, was keynote speaker. The Yale-New Haven Collaborative, a Carnegie-funded science collaborative, was experiencing funding problems due to its lack of a strong link with industry. Many questions were directed at the representatives from Cleveland, as the Cleveland mathematics collaborative is viewed as being quite successful in this regard.

E. Project Activities

C^2ME's goal is to provide enrichment opportunities for teachers in industrial and university settings, to provide opportunities for teachers to engage in independent learning in advanced mathematics, to increase teachers' understanding of current applications of mathematics, to increase teacher collegiality and to eliminate barriers to professional collegiality, to offer opportunities to teachers for intellectual stimulation and renewal, and to provide teachers with opportunities to learn new approaches to mathematics instruction.

During summer 1986 and the 1986-87 school year, C^2ME offered a wide variety of in-school, out-of-school and networking activities for teachers. The Cleveland Education Fund also sponsored a series of luncheons for business leaders in the community, at which the collaborative's work was featured. A number of activities sponsored by other institutions also offered significant opportunities to area mathematics teachers. The collaborative supported these related activities by publicizing the events and in some cases, providing teachers funds to allow them to participate. These activities are described in this section. Activities directly sponsored by the collaborative are listed first, followed by activities for which the collaborative provided active support. In all cases, C^2ME served as a vital, proactive link between Cleveland mathematics teachers and a wide range of professional enrichment opportunities available to them.

Calculator Workshop

On September 13, an in-service workshop for intermediate mathematics teachers was held at the Hilton Inn. The workshop was designed to help teachers feel comfortable working with calculators and with integrating them into the curriculum; it was the first systematic calculator curriculum to be introduced in the Cleveland Public Schools. Fifty-one intermediate teachers attended. C^2ME plans to assist in developing, disseminating, and implementing new units and activities developed as a result of the in-service training. These calculator activities will be integrated into intermediate and high school courses. A make-up workshop for an additional fifteen teachers who were unable to attend the initial workshop was held November 18.

The calculator project exemplifies C^2ME's creative funding techniques. The Cleveland Education Fund paid $5,000 for the calculator materials; the Cleveland Public Schools paid teachers for their attendance at the in-service training sessions; and the State of Ohio paid for three national trainers, a facility and refreshments.

GCCTM Display

The collaborative sponsored a display area at the fall meeting of the Greater Cleveland Council of Teachers of Mathematics (GCCTM). Staffed by secondary school mathematics teachers from Cleveland Public Schools, the display disseminated information and materials and promoted networking and collegiality in an effort to strengthen the link that exists between C^2ME and GCCTM.

Dinner Symposia

During the 1986-87 school year, the collaborative sponsored two Higher Education and Business/Industry Symposia. The symposia were designed to meet two primary goals: (1) to provide teachers with a forum for dialogue and interaction with their peers and with representatives of business, industry, public institutions, and higher education; and (2) to provide teachers with insights into current and future mathematical applications and topics.

Case-Western Reserve and IBM. On December 2, Case-Western Reserve University hosted and IBM sponsored an evening of mathematics for Cleveland mathematics teachers. Sixty-three mathematics teachers attended the symposium, along with thirteen members of the C^2ME advisory board. Dick Baznick (special assistant to the president) began the evening with a welcome to the teachers and a brief overview of the evening's activities; teachers then had the opportunity to attend one of three concurrent sessions. Their options included: 1) Mathematics in Business--A tour of a microcomputer laboratory at the Weatherhead School of Management, hosted by Dr. Miles Kennedy; 2) Artificial Intelligence and Robotics--A visit to the Center for Automation and Intelligent Systems Research; 3) Probabilities in Everyday Life--A visit with Dr. John McGervey, Professor of Physics at C.W.R.U. and author of a recently published book on this topic.

Following these sessions, teachers, university professors, business representatives, and members of the Advisory Board gathered for cocktails before dinner. After dinner, Dr. Philip J. Davis, professor of mathematics at Brown University, discussed "Napoleon's Theorem: The Importance of Geometry." Dr. Davis' presentation emphasized the importance of the mathematics teacher as a motivator to students. The entire program was well received by the teachers.

National City Bank Operation Center. On May 6, 1987, a dinner symposium was held at National City Bank Operations Center. Thirty-nine teachers toured the Center and heard Dr. Kenneth Cummins of the Department of Mathematical Sciences, Kent State University, speak on "Helping to Motivate Students in the Study of Mathematics." Dr. Cummins suggested using physical materials or instruments to show mathematics at work, and using mathematical or arithmetical oddities, historical tidbits, and effective methodology and approaches in teaching. The teachers' evaluations indicated that they appreciated Dr. Cummins' presentation and enjoyed the tour of the National City Bank Operations Center and the discussion of the mathematics of banking.

Teachers were integrally involved in the planning of this activity. Two teacher-members of the Problem Solving Standing Committee toured the facility prior to the function. They spent time with the presenters, and reached an agreement on what content would be relevant for teachers to hear about while on the tour. These teachers also developed a packet of problems that was distributed to other teachers on the day of the visit.

One teacher commented, "Excellent! Dr. Cummins was great, really relevant material and motivational. Collaborative activities give a sense of worth to teachers." Another said, "[This was] one of the best presentations. It was down to earth... what I am preparing my kids for. Well designed and prepared." Although the teachers enjoyed the symposium and thought it was worthwhile, some felt that it was too long, particularly after a full day of teaching.

Superintendent of Schools Al Tutela attended the dinner symposium, the first C^2ME activity in which he participated. Tutela noted that the teachers' attendance at events such as the symposium indicated their dedication and their commitment to quality education in Cleveland.

The dinner symposia were among the most popular of C^2ME activities. Teacher evaluations suggested that a major factor in the symposia's success was that they provided an opportunity to "talk with colleagues." Other positive features listed included the tours, the exposure to the uses of mathematics in business and industry, and the distribution of free materials.

Algebra Competition

The First Annual C^2ME Algebra Competition was held at John Carroll University on May 16, 1987. The contest was designed to promote mathematics through competitive events, and to help encourage teachers to cover the breadth of content specified by the curriculum. Twenty-seven teams from sixteen schools participated, for a total of 108 students and twenty coaches. Any student enrolled in Algebra I was eligible to compete. Students were enthusiastic, and both students and teachers enjoyed the event. Every participant received a ribbon and an "I Am a Mathemagician" t-shirt from the Aetna Foundation; certificates and refreshments were provided by John Carroll University. Teachers expressed their belief that competition in an academic event was very helpful in generating enthusiasm, and that visiting a college and hearing both the university president and the mathematics department chair speak to the students was beneficial. One university professor noted that: "The fact that we have gotten as many students as we have practicing and participating, and that teachers have given their time, shows that students are interested in mathematics." It is anticipated that next year, geometry and algebra contests will be held, with John Carroll University again acting as host.

Oberlin College Mayfair Festival

As part of Oberlin College's Mayfair Festival, C^2ME and Oberlin College jointly sponsored special activities for Cleveland Public School teachers on May 2, 1987. These activities, which were offered to teachers free of charge, included a tour of the Oberlin campus, a tour of the art museum with a view toward understanding the artist's mathematical problem-solving approach, a reception in the museum courtyard, a dinner, and attendance at the play, "The Miser," by Moliere. Due to conflicting activities, only five CPS math teachers and one CPS supervisor were able to attend the festival. All the teachers who attended felt that the event was very worthwhile. Also in attendance were the Chair of the Mathematics Department at Oberlin, Bob Young; Rudd Crawford; Dean Wolfe, Director of the Oberlin Teachers' Academy; Suzanne Haggerty, the C^2ME coordinator; and teachers' guests.

Retirement Dinner

On June 4, 1987, a dinner was held honoring eleven retiring mathematics teachers from the Cleveland Public Schools. It was planned and implemented by the Math Teachers Resource Center of C^2ME. Each retiree received a plaque and a small gift. The event was well received by the approximately thirty-five teachers who attended. One teacher noted that it was the first time in his memory that the mathematics department had been invited to this type of event and remarked that it was refreshing to honor people who have given many years of service to the school system. It was suggested that such an event be held every year.

Teacher Scholarships

As part of its commitment to C^2ME, the Department of Mathematics at John Carroll University continued to offer tuition scholarships to mathematics teachers in the Cleveland Public School System. These scholarships covered tuition for university mathematics courses, ranging from introductory calculus and statistics to graduate courses in the department's Master of Arts and Master of Science programs. Scholarships, awarded on a competitive basis by a department committee, were granted to two teachers during the 1986-87 school year. In the summer of 1987, one teacher received a full scholarship for 6 credits of work in the Master of Science Program.

The Martha Holden Jennings Foundation awarded a scholarship to a Cleveland Public Schools mathematics teacher to attend a one-week workshop on problem solving during the summer of 1986. The workshop was led by Dr. Johnny Hill of Miami University.

Project Advance

Project Advance was made possible by a grant from the Ohio Board of Regents. The project represented a joint effort of C^2ME, Cuyahoga Community College (CCC), Notre Dame College, John Carroll University, the Cleveland Public Schools, and TRW. The project provided an in-service experience for science and mathematics teachers, giving them new concepts and approaches for relating math and science teaching. The workshop was open to all area intermediate school mathematics and science teachers. Two CPS secondary mathematics teachers attended. The project was coordinated by CCC, instruction was provided by Notre Dame College, and two hours of graduate credit were provided through John Carroll University.

Teacher Internships

The Cleveland's Teacher Internship Program was established in 1980 to provide teachers with hands-on experience involving the mathematics used daily in business and industry. The program organizes summer work placements for teachers in area businesses or industrial labs for which teachers receive a stipend. In the summer of 1985, C^2ME coordinated ten placements in industry and, in a parallel effort, identified one person for an internship at Cleveland State University. In the summer of 1986, six teachers were placed in industry internships, and one was placed at Cleveland State University. While the original two-year internship plan anticipated a total of ten internships, C^2ME has generated eighteen internship placements during that period. (Prior to

C^{2}ME's efforts, only one Cleveland Public Schools mathematics teacher had been placed through CTIP.)

An internship generally lasts eight to ten weeks. In addition to working at the corporation, teachers attend five to seven Wednesday afternoon seminars during the summer and also prepare a new learning project for their own classrooms. Teacher interns enroll for one to seven graduate credits at CSU to earn credit for these projects. Interns meet in October to share their projects.

During the summer of 1986, those who were first-year interns received \$500 per week, while those doing a second-year internship earned \$550 per week. Third-year interns received \$600 per week and fourth-year interns \$650 per week. These amounts did not depend on grade level or subject matter. Many of the teachers participating in the 1986 programs had worked as interns in 1985. In questionnaires completed by five of seven teachers who participated in 1986, four of the five said they could integrate their work experience directly into their teaching or into the mathematics curriculum. All five of the teachers stated that they felt that curricular changes are needed if students are to meet the expectations of future employers.

Fifteen Cleveland Public School teachers have been selected by five corporations to serve as interns through Cleveland's Teacher Internship Program during summer, 1987. Of the fifteen, seven are mathematics teachers.

Cleveland Mathematics Teachers Resource Center

The Cleveland Mathematics Teachers Resource Center opened October 1, 1985, at the Metro Campus of Cuyahoga Community College. Three Cleveland Public Schools mathematics teachers were hired to establish and staff the Resource Center. Two of these three positions were restaffed at the beginning of the 1986-87 school year in order to provide several teachers an opportunity to work at the Center.

The Center provides Cleveland Public Schools mathematics teachers with opportunities for training, collegiality and information to enhance their knowledge and expertise as teachers. The Center also serves as the hub of curriculum development, in-service training, and collection and distribution of materials. It provides consultation services and distributes a list of suggested materials to each department chair in order to encourage mathematics departments to obtain supplemental textbooks, supplies, and materials such as calculators to help teachers implement an activities-based approach to mathematics instruction. In addition, the Center publishes a calendar of C^{2}ME activities and relevant information about other mathematics events sponsored by higher education, business, and industry, and distributes it to all secondary school mathematics teachers in the Cleveland Public

Schools. Packets of "teasers" and suggested classroom activities highlighting problem solving are compiled by Resource Center staff and distributed to teachers. During the 1986-87 school year, a computer, laser printer, modem and graphics software were purchased for the Center as part of a grant from Aetna Life and Casualty Foundation. This enabled the Center to produce its calendar and other flyers in-house.

Throughout the 1986-87 school year, the Resource Center offered informative programs and workshops; it was also the site of a variety of meetings, including those of the Test Construction and Textbook Selection Committees, and School Mathematics Department meetings. The Center is closed during the summer.

Between October 1, 1985, when the Center first opened, and December, 1985, eighty-five teachers took advantage of its resources. During the same months in 1986, the number of visits to the Center increased to 243, and by the end of June, 1987, the number of visits had increased to 473. Nearly all of these visits were made by teachers. This clearly demonstrates that Cleveland teachers recognize the importance of the services the Resource Center provides.

C^2ME Newsletter

During the 1986-87 school year, the collaborative's quarterly newsletter continued to be distributed to teachers and to Advisory Board members. Three hundred copies of the spring newsletter also were distributed to Cleveland area businesses. The newsletter includes articles on C^2ME's goals, descriptions of programs and offerings to teachers, and recognition of teachers for both their personal accomplishments and their participation in C^2ME activities. Bob Seitz, a Cleveland Public School mathematics teacher and the collaborative on-site observer, edits the newsletter.

Seminar in Advanced Technologies at Lorain County Community College

The fourth seminar series in advanced technologies at Lorain County Community College was held April 21-24, 1987. (The first three seminar series were held in April and June, 1985, and in April, 1986.) The five-day program was designed to broaden the experience of selected high school mathematics teachers by enabling them to participate in an optional introductory session on the IBM PC, followed by a series of four 4-hour advanced technology workshops in the areas of computer-aided graphics and design, computer numerical control of machinery, robotics, and statistical control of processes and quality. Instructors presented the basic concepts of new technologies and highlighted the integral part that mathematics plays in each. Teachers devoted afternoons to small-group work on lesson planning, so that at the conclusion of the course participants were able to formulate and present plans for further study in the technical area of their choice. In addition to tuition grants and lunch allowances, teachers received $100 stipends.

Five Cleveland mathematics teachers participated in the workshop. Teacher evaluations were extremely positive. The quality of content and instruction for each of the sessions was judged "very good" to "excellent" by all participants. In general, most teachers thought that the program was applicable to the high school classroom and was useful in improving their teaching. One teacher noted that "the information and illustration along with classroom teaching, would provide students with a quality education." Another wrote, "Good examples of industry to take back to the classroom. A very informative workshop." A third teacher mentioned that although "it was not pertinent to math teachers, . . . we in the Cleveland system need to infuse the idea of employability skills for students so the ideas were good."

Oberlin Problem-Solving Workshop

Six secondary school mathematics teachers received collaborative funding to attend a workshop in problem solving at the Oberlin Teachers Academy from June 16 to June 28, 1986. The workshop was designed to sharpen teachers' skills, to help them build a problem-solving library, and to guide them in preparing a plan for classroom implementation. The seminars were taught by Dr. Rudd Crawford, a mathematics teacher at Oberlin High School and the director of the STELLA project in problem solving--a project for which he has received national recognition. Dr. Crawford is also half-time instructor at Oberlin College.

All of the participants felt the workshop was worthwhile and said they would apply what they had learned in their classrooms in the fall. The teachers also stressed the value of meeting and working with other mathematicians. One teacher said, "The activity was excellent; I would advise it for everyone. It should be mandatory for teachers who have not been in class for awhile." Other comments included: "I would like to see every Cleveland teacher exposed to this activity. I received an organizational framework for giving non-routine problems in a systematic fashion"; "The experience is a rich resource for future planning in the teaching of mathematics, for networking with other math teachers in the Cleveland Area and for future professional growth"; and "I think that the two-week workshop has been very helpful to me. It gives me something concrete to take back and try in the classroom. Our own problem-solving skills were increased also. The workshop really motivated me to do more with problem solving."

The collaborative paid the six teachers who attended the Oberlin workshop to spend two weeks organizing and further developing the problem-solving materials, and to plan two one-day workshops in August on problem solving for Cleveland mathematics teachers.

At a meeting of the Advisory Board in February, 1987, Rudd Crawford described the great enthusiasm of the Cleveland teachers who had attended the Teachers Academy. He credited them as the driving force behind dissemination of the problem-solving materials.

Problem-Solving In-service for Intermediate and High School Teachers

The summer Oberlin problem-solving workshops were so well received that the district decided to follow up with two, one-day in-service programs for all Cleveland Public School teachers in grades 7-12; the programs were initiated by the teachers who had gone to Oberlin. Bill Bauer, working with teachers and university professors, developed the details for the district-wide in-service. A total of 137 of the 186 eligible mathematics teachers attended one of the two days. On August 25, fifty-eight seventh- and eighth-grade mathematics teachers, approximately 75% of those in the district, attended the workshop. On August 27, seventy-nine high school mathematics teachers, approximately 80% of those in the district, attended.

The workshops' main purposes were to promote problem solving, to foster collegiality among teachers, and to increase teacher awareness of programs and opportunities available to them. At each of the in-service sessions, Rudd Crawford of Oberlin College explained his problem-solving techniques and gave each teacher a box of fifty-one problems that were prepared by teachers who had attended the two-week workshop held at Oberlin in June. Teachers also received other curriculum materials, applications to join professional organizations, and a summary of anticipated developments in the Cleveland schools in the near future. An overview of the collaborative and the activities it sponsors also was presented.

The teachers seemed quite impressed with the workshop. Many commented that it was the first time in many years that the district had paid attention to mathematics teachers, had given them a "big picture" of the curriculum, or suggested specific equipment or materials. Most of the evaluations were very good, with many teachers expressing an interest in more workshops. Comments included: "The session was very impressive, real needs were systematically satisfied. Materials are very useful and could only be acquired personally with many hours of effort. Congratulations"; "Forces me to do what I should do. Certainly worthwhile"; and "I liked receiving immediately usable materials, a lot of structure for the year. Very good kickoff for the new school year."

A make-up problem-solving in-service was offered on October 9 to those teachers who were unable to attend the original in-service. Sixteen teachers attended.

The district will fund another session of the problem-solving workshop during the summer of 1987.

Problem-Solving Weekend Seminar Series

Six weekend seminars similar to the Problem-Solving Summer Workshop were scheduled at Oberlin College during the 1986-87 school year. Sessions were offered October 3 and 4; October 31 and November 1; November 21 and 22; March 6 and 7; March 13 and 14; and May 8 and 9. Each session included a Friday dinner meeting, night lectures, and a Saturday breakfast meeting with further sessions lasting into the afternoon. Fifteen collaborative teachers attended the first session, eleven attended the second, and five attended the third. The remaining places were filled by teachers from neighboring districts. The reduction in teacher participation during the spring semester can be interpreted as a reflection of the need to refocus this type of activity. By the end of 1986, one quarter of the target population had taken part in the summer workshop or weekend seminars.

Participants in the first workshop felt it was worthwhile, although some believed there was too much to do in the short time allotted. One teacher commented: "It was an opportunity to exchange ideas with other mathematics teachers. It was refreshing without being pressured on deadlines." Another observed: "The concept is worthwhile--developing a long-term project that people need help in. . . . I was rushed, should be longer than one weekend. . . . I expected more on 'techniques' of teaching problem solving!" After the second workshop, a teacher commented: ". . . I loved it because we worked together with other math teachers, had a nice time, did real mathematics. . . . Teachers were confident, a step ahead because of our August workshop."

Mixing with colleagues from outside the local system appeared to add an important dimension to the activity. Teachers selected to participate in the sessions wrote problems that were added to the bank of problems that had been distributed at the August workshop.

As a result of the enthusiasm generated by these sessions, a Problem Solving Standing Committee of Cleveland teachers was formed to collect data about the use of the problems and to develop and distribute additional problems. A survey of teachers was conducted to determine what needs were not being met.

Baldwin Wallace Workshop

In October, thirteen intermediate school teachers were selected to attend workshops on the implementation of student-centered activities. The workshops, which were offered every Wednesday for ten sessions through the months of October, November and December, covered topics related to the incorporation of MathCounts into the curriculum. Dr. Richard Little, who is a professor of mathematics and computer science at Baldwin-Wallace College, a judge in the MathCounts contest, and chairman of the C^2ME Advisory Board, planned the workshops in consultation with the Cleveland Public Schools supervisor of mathematics. Six teachers earned three hours of college credit for their participation.

Conference on Computers in Secondary School Mathematics

Two teachers from the collaborative were selected to attend a six-day conference on computers and secondary school mathematics. The conference, held at Phillips Exeter Academy in New Hampshire in June, 1986, focused on the impact and application of the computer on the curriculum. Funding for the teachers was provided by the Technical Assistance Project at the Education Development Center, Inc. After returning from the conference, one of the teachers held workshops for colleagues at the Mathematics Teachers resource center on the use of a program he wrote to replace the grade book. The other teacher works in the district's Computer Center, and has continued offering workshops involving issues and content relevant to the Exeter meeting. The teachers were also involved in curriculum development with other teachers and the Cleveland Public Schools supervisor of mathematics; however, the extent of the follow-up was limited by the fact that much of the software distributed at Exeter was not compatible with the computers that are used in the Cleveland Public Schools.

In June, 1987, a teacher from the collaborative attended the 1987 Conference on Secondary School Mathematics and Computers at Phillips Exeter Academy. The conference focused on providing exposure to new concepts in integrating computer technology into the existing curriculum. The teacher's trip was funded by the UMC Technical Assistance Project at EDC, Education Development Center, Inc.

Small Grants Program

C^2ME has made a concerted effort to encourage teachers to apply for small grants. Two informational meetings for mathematics teachers were held to explain the "research and test" philosophy of the small grants program, and the Small Grants Booklet was distributed to all mathematics teachers in September, 1986. This booklet lists the names, telephone numbers, and project descriptions of teachers who have received small grants. A typical small grant award averages $440.

During the last three years, small grants totaling more than $10,000 made available by General Electric were awarded to mathematics teachers to fund mathematics pilot projects; eight grants were made to secondary school mathematics teachers during 1984-85, seven during 1985-86, and ten totaling $4,602 during 1986-87. Prior to C^2ME's involvement, only one small grant had been awarded to a Cleveland Public School mathematics teacher. Some teachers who received small grants had prepared and submitted projects as a result of their experience in the advanced technology seminars at Lorain County Community College.

The small grants program, in general, was well received by teachers. One teacher commented: "The small grants program allowed me to give my students the WHY of learning mathematics."

Professional Meetings

C^2ME is committed to increasing the attendance of Cleveland Public School secondary mathematics teachers at professional meetings, as traditionally low attendance is considered an impediment to the professional renewal of teachers.

The collaborative sponsored and paid travel and lodging expenses for ten mathematics teachers to attend the annual meeting of the Ohio Council of Teachers of Mathematics in Cincinnati in March. The collaborative arranged funding for Bill Bauer to attend the annual meeting of the National Conference of Supervisors of Mathematics annual meeting in California in April, 1987. It also identified funds so that Bill Bauer, Dick Little (Chair of Mathematics and Computing Department of Baldwin Wallace College, and the C^2ME Advisory Board chair in 1986-87), and Rudd Crawford could attend the Harvard Regional Mathematics Network information session. These three heard about what Harvard was producing. The information they received was helpful in writing a proposal to NSF for money to finance the Problem Solving Infusion Project which is described in the Next Steps section.

Community Leaders Luncheon

Four times a year, the Cleveland Education Fund sponsors a luncheon and afternoon meeting for community leaders. One purpose for these meetings is to keep these people informed of what is happening with the Fund's projects. The luncheon is attended by the Chief Executive Officers of area corporations or their representatives, people from universities, and representatives from key community organizations.

F. Observations

The Cleveland Collaborative for Mathematics Education has continued to progress during the 1986-87 school year. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

Management of the project remained in the capable hands of Paula C. Fay. In spite of the turnover in coordinators each year, the project has continued to progress and to offer a rich and varied array of activities that have been well received by teachers. Three characteristics of the Cleveland collaborative seem to have allowed such steady progress, even in the face of major personnel changes: (1) the professional strength of the director, and her solid and enduring leadership; (2) the cooperative relationship between the collaborative and the supervisor of mathematics from the Cleveland Public Schools; and (3) the high priority placed on teacher involvement very early in the collaborative's development, so that a strong core of teachers have emerged who participate frequently in collaborative activities. Together, the director, the mathematics supervisor and the teachers have maintained a strong vision that provides continuity.

The Cleveland Collaborative for Mathematics Education has achieved a level of success that has drawn national attention. The Cleveland Foundation used the C^2ME as one of the featured segments at its annual meeting. The author of a forthcoming book under the auspices of the Carnegie Foundation visited the collaborative to seek information on the topic of "teacher empowerment."

There is some question, however, as to the degree of teacher involvement in the collaborative's decision-making process, or, at least, in teachers' awareness of the opportunities for this type of involvement. The seven teachers who serve on the Collaborative's Advisory Board do provide some teacher input. The Teacher Advisory Board can also provide an opportunity to garner additional teacher feedback. Since the Teacher Advisory Board met only once during the year, however, in actuality it has not been very active in decision making. Some teachers have commented that collaborative decisions seem to be made by the Cleveland Education Fund. It appears that more teacher involvement in decision making is warranted, or that more teachers need to be made aware of their peers' involvement. Teachers need to know that their coworkers are actively participating in the collaborative's management and decision-making procedures.

While some teachers perceive that the collaborative is an externally provided resource base, other teachers are highly involved. These mathematics teachers have conducted workshops through the Resource Center, worked on a display for the Greater Cleveland Council of Teachers of Mathematics fall meeting, and planned the retirement dinner. The variation of involvement of teachers is an indication of growth. While there are teachers who have been engaged in planning and presenting activities, other teachers are primarily clients or receivers of services provided by other teachers and by those from the other two sectors.

The Teacher Resource Center provides a centerpoint for observing both the positive thrust of the collaborative, and the effect of the relative isolation of the various interest groups involved. Formally staffed for three hours every afternoon from Monday to Thursday, the center is used regularly by individual teachers as well as by school and district committees. In part this high level of use is due to type and quality of materials the center contains; just as important is the fact that the center is open at a time when janitorial contracts make it expensive or otherwise difficult to meet in school buildings. The center also represents a neutral ground. The center serves a dual function: it is a materials and meeting resource for teachers, and a printshop for the collaborative. While it is appropriate that the center fills both of these rather complementary roles, the situation does create a degree of competition among users for the center staff's time.

While these observations embody an evaluation of the center and its role, it should be remembered that the center represents one of the collaborative's real success stories in that it has brought some real changes to the lives of a number of teachers who are working in a district that suffers from profound financial and material problems. It would be an error to focus on the issues of concern without placing them in the overall context of a vital, successful project.

COLLABORATION

The collaborative aspects of C^2ME have expanded during the past year. Strong support from business and industry, first demonstrated when the collaborative was initiated, has not diminished. Cooperation from higher education, initially lacking, is now beginning to emerge. Most important has been the evolution of a strong core of mathematics teachers with the potential to exert influence on the scope and direction of C^2ME. This potential is starting to be realized through the teacher representatives on the Advisory Board, a trend that is being encouraged and facilitated by the efforts of the district mathematics supervisor. In one of the most interesting developments to date, teachers have drawn on considerable input from university and industrial mathematicians to create curriculum materials for their own use. For example, the development of problem-solving activity kits was supervised and assisted by Rudd Crawford from Oberlin. The involvement of members of the Advisory Board in supplying material for a consumer mathematics course to replace Shop Math further demonstrates the potential benefits of building collaborative relationships.

In the beginning of C^2ME, the collaboration consisted mainly of business and university sectors supporting teachers rather than interacting with them. Some teachers, therefore, perceived that collaborative activities were being organized for them, rather than by them. The collaborative was seen as a source of resources rather than as a cross sector interface. As the collaborative developed, teachers have been able to network among themselves, an opportunity which is of great value. The broader interaction with other mathematicians in business, industry and higher education is also evolving. This is essential if political support is to be established for enhancement of the profession of teaching. Examples of activity planning now occurring in the Cleveland project illustrate the growth of this kind of interaction between groups.

The algebra contest was an example of a collaborative effort among the various sectors; it was a very positive experience which significantly involved teachers, university mathematicians, business people, parents, and students. A committee of four university mathematicians and two public school teachers met several times, beginning in January, to identify appropriate items to establish the format. The university mathematicians and teachers conducted the contest. The teachers coached their students. Aetna and John Carroll University funded the event, with Aetna providing 1,000 silk-screened t-shirts. The students trained and participated in the contest, while parents saw to it that students had transportation to and from the event.

In the future, perhaps, the contest will be viewed as an opportunity for more teachers and university mathematicians to work closely together for the benefit of all involved. The challenge to C^2ME is to determine ways for more teachers to experience the collegiality that is developed through working together for a common goal. Through such interaction, university professors can come to know more about the teaching of algebra in the high school classroom, and more teachers can gain a greater understanding of what universities expect students to know about algebra.

An important and interesting component of the activities of C^2ME involves the attention the project pays to its business sector. Two activities are cases in point: First, the Cleveland Education Fund sponsors luncheon meetings at the Union Club for business leaders at which C^2ME activities are noted. Second, the collaborative mailed 300 copies of the April 1987 C^2ME newsletter to area businesses. The business community has exhibited strong support for the collaborative, as well as a willingness to provide financial support. For example, Holcolm donated a $360 desktop publishing workshop for the Teacher Resource Center, and the Aetna Foundation awarded the project a grant of $22,000.

Long-term school-district support for the activities of C^2ME is problematic, given the history and volatile nature of the politics and relationships between the School Board and the administration. However, there seems to be a feeling that the new superintendent is at least sympathetic to the collaborative; whether this support stems from his perception of the project as a source of additional resources at a time of great shortage is a moot point. The collaborative, by virtue of the linkages it has strengthened among teachers, has a potential for transforming relations between teachers and their employers.

Bill Bauer's strong support for the collaborative was acknowledged in a letter to Superintendent Tutela from the Chair of the Board of Trustees of the Cleveland Education Fund. Mr. Bill Madar wrote: "With Bill Bauer's support, the mathematics teachers have truly taken ownership of the activities of C^2ME. Their increased participation, leadership, energy and enthusiasm have not gone unnoticed by The Ford Foundation or by other cities. Cleveland's C^2ME has become a model of success."

TEACHER PROFESSIONALISM

Activities sponsored or supported by C^2ME have been rich and varied, and they have provided all teachers in the district opportunities for professional development. A very active core group of teachers has organized, developed, and participated in many of the activities. This enthusiastic core is expanding, and the conviction and work of its members are beginning to overcome the hesitation of their peers.

The pay scales in Cleveland are now quite high, and teachers are reasonably well buffered from the bulk of school board politics. While teachers are prepared to engage in professional activities on their own time, it has been difficult to attract them to after-school sessions without payment. Some teachers hold second jobs, from teaching a graduate course at a local college to working for a department store on weekends. In spite of these commitments, however, the participation rate of teachers in collaborative programs has been extraordinarily high. In 1986, 54% of teachers attended at least one collaborative activity. In an address to area businessmen, Bill Madar suggested that this was a level of voluntary participation that any corporation would be pleased to achieve! By May, 1987, 81% of the teachers had participated in at least one activity, 62% had attended two or more activities, 43% had attended three or more, 28% had attended four or more, and 17% had attended at least five. There are twenty-three schools at which all the teachers have attended at least one collaborative function. By August, 1987, 83% of the total 186 teachers had participated in at least one activity.

Analysis also indicates that the number of teachers who have participated in two or more activities has doubled when compared to the prior 18-month period. Participation in three or more activities has increased two and one-half times, and participation in at least four activities has tripled. Participation in at least five activities has increased from 10 percent to 27 percent, representing a core group of forty-six teachers.

For teachers who have not become involved, however, a "working-place mentality" still exists, as exhibited by their comments at the August problem-solving workshop. Most initial questions addressed such topics as who was paying for parking and lunch. These teachers are accustomed to being treated as conduits in a system, as workers on an assembly line, and they expect to be regarded as such. For some, demands for more money become a way to strike back at a system that has treated them unprofessionally.

In Cleveland, teachers are working within a framework in which the state formally approves curricula; this tends to be taken as virtually automatic. The supervisor of mathematics has encouraged teacher involvement in text selection, and the writing of the district-wide midyear and end-of-year tests.

Teachers were selected by math supervisor Bill Bauer to write midterm and final exams for all of the secondary mathematics courses (Consumer Math, General Math, Introductory Algebra I and II, Algebra I, Geometry, Algebra-Trigonometry, Advanced Math, and Calculus). A team of twenty-three teachers revised the pupil performance objectives and developed midterm examinations that were administered in each district school in January. The committee then worked during the spring to develop final exams, which were administered at the end of the school year. Reaction to the tests was very favorable.

In addition, during the 1986-87 school year, more than 100 teachers were involved in pilot testing new mathematics textbooks. Textbook committees composed of these teachers are currently selecting books to be purchased for the various courses. These processes have allowed teachers to provide input into the mathematics curriculum and to feel ownership of the mathematics program. This feeling was expressed by the on-site observer when he said, "The collaborative has succeeded in giving the teachers a voice in the decision-making process and giving us the recognition we deserve."

The mathematics supervisor also has actively supported teachers seeking to attend professional conferences. The collaborative has successfully provided a context within which the district has allowed some teachers to attend the local annual meeting of NCTM.

There is no question that the core group of teachers who have actively participated in C^{2}ME during the past two years have gained a real sense of professionalism. These teachers are receiving recognition and assuming responsibilities that they have never before experienced. For example, Bob Seitz, an active teacher member of the collaborative and the on-site observer for the Documentation Project, is a nominee for a Presidential Award for Excellence in Teaching Mathematics. Furthermore, Mr. Seitz's Academic Decathlon Team defeated five other teams (including four from the suburbs) in the Ohio Academic Decathlon. His Academic Challenge Team was presented to the Board of Education and praised for its success in the televised competition. Mr. Seitz was asked to address the 900 people who attended the Academic Decathlon Banquet.

It appears that teachers are not the only participants who have been empowered as a result of the collaborative; the position of the school district's mathematics supervisor has been strengthened substantially through his association with the collaborative and as a result of its legitimacy in the community and school district. In addition, the mathematics supervisor has discovered new ways of involving teachers, has realized the value of that involvement, and has developed creative ways of using in-service funds to enhance the professionalism of teachers.

MATHEMATICS FOCUS

The Cleveland Collaborative focuses on mathematics education, rather than on mathematics as such. The textbook committees organized by the mathematics supervisor, the grant application to the National Science Foundation, operation of the Teacher Resource Center, and support of attendance at local NCTM meetings and at the Phillips Exeter conference provide teachers with opportunities to develop pedagogical skills, to influence curricular content (albeit within the constraints of publishers and the state curriculum), and to develop classroom materials.

Within this more general orientation, the project's specific foci relate to problem solving in mathematics classrooms and the use of calculators as classroom tools and as teaching aids.

G. Next Steps

The collaborative recognizes that it must have vision in order to make a lasting impression. This vision would dictate the following:

1. The programs must form a coherent whole, building upon one another to address identified needs. For example, the Ohio State Pre-Algebra Demonstration Project will build on the skills and knowledge developed in the current calculator project.

2. Careful consideration must be given to continued financial support. Creative fundraising is the key. The collaborative will continue to look for ways to tap existing local, state, federal, and national funding.

3. Teacher support must be maintained and increased. A danger exists that teachers' energies will be spread so thin that programs will become ineffectual, and sufficient follow-up will not occur. Symposia must remain novel and stimulating, workshops must be highly applicable to the classroom, support must be forthcoming. The core group of teachers must be strengthened and expanded so that it becomes the teachers who are motivating the improvement. Strengthening the network between teachers will be a major step toward this end.

Several steps were initiated to encourage communication among teachers. First, C^2ME is creating the "Schoolhouse" on Free-Net, which is a free community-access bulletin board based on a representation of an entire electronic city. The "Schoolhouse" will include an information desk, school bulletin board, teacher's lounge, library, counselor's office, mathematics center, and C^2ME room. This facility will enable instantaneous communication between teachers in locations across the city. Modems have already been distributed to several high schools. Communication among teachers has been facilitated this past year by improving the in-house printing capability of the Math Teachers Resource Center by the addition of a laser printer and software. Calendars are being produced less expensively and more quickly. Flyers are being readily produced to announce changes and new activities, and to serve as reminders. In all of these efforts, teachers are working for teachers, so that power springs from within.

Several collaborative efforts directed at meeting these goals are now in the planning stages.

NSF Proposal

The Cleveland Collaborative for Mathematics Education is currently in the process of submitting a four-year NSF grant to enhance the teaching of problem solving at the seventh, eighth, and ninth grade level. The proposal has basic components: 1) Curriculum development, 2) Staff development, 3) Dissemination, and 4) Evaluation.

Unique aspects of the program include the use of the Free-Net bulletin board at Case-Western University to share problems with teachers throughout the district and suburban schools. In addition, a series of notebooks containing worksheets, problems and transparencies will be developed.

Mathematics and Technology Human Resources Enrichment Project (MATH REP)

The Ohio Board of Regents made a grant of $41,000 for a partnership project of C^{2}ME, Baldwin-Wallace and Cleveland Public Schools. The project, entitled the Mathematics and Technology Human Resources Enrichment Project (MATH REP), will begin June 16, 1987, with a three-week workshop. MATH REP addresses the underpreparedness of mathematics teachers in the intermediate schools. During the MATH REP summer program the ten guest speakers will include Ohio recipients of the Presidential Award for Excellence in Teaching Mathematics, text authors, and an IBM education specialist. Director Little will teach one session each day on geometry and problem solving, and associate director Bauer will teach one session each day on number theory, calculators and classroom procedures. These class sessions will be one hour and 45 minutes each. The participants will attend the Paul Klee exhibit at the Cleveland Museum of Art. Klee has taught mathematics at the Bauhaus and has used geometry extensively in many of his paintings and sketches. Tours of NASA Lewis Research Center Museum and the computer center of Cedar Point Amusement Park will also be part of the program.

NCSSM Workshop

The Mathematics Department at North Carolina School of Science and Mathematics (NCSSM), working with a grant from the Carnegie Corporation of New York, is developing a syllabus for fourth-year college preparatory mathematics. The syllabus is being seen as the future trend in mathematics education. NSF has funded a project to train teachers in the use of the syllabus. This project matches the objectives of the collaborative. First, it provides teachers with staff development activities in the future trends of mathematics. Specifically, teachers will become familiar with recommendations about the secondary mathematics curriculum from NCTM, MAA (Mathematics Association of America), CUPM (Committee on the Undergraduate Program in Mathematics for MAA), NSF, and the Department of Education. Second, and most important, it provides a model of teacher training in which teachers take a leadership role. It is a model of empowering teachers within their profession, giving them greater involvement in mathematics education. Three teachers from CPS School of Science will attend a training session in North Carolina from July 5-July 17, 1987. These teachers will pilot the materials during the 1987-88 school year and conduct a five-day workshop for CPS teachers during the summer of 1988.

Preparation for College Mathematics

C^2ME and the Cleveland Public Schools will be working with Ohio State University on four separate projects next year. Those are:

1) Approaching Algebra Numerically (AAN) - This program, recently funded with a $44,000 grant from the Ohio Board of Regents, focuses on instruction in seventh and eighth grade using scientific calculators. Fifteen CPS teachers will attend two days of instruction split between mathematics content and pedagogy. The first session will provide an overview of the materials to be piloted and an introduction to techniques of using the calculator with children in the intermediate schools. The second session will examine the table-building, guess-and-check problem solving process. The instructors are Alan Osborne and Franklin Demana of Ohio State University.

2) NSF-funded Squeeze Play Project - This project for teachers in the ninth, tenth and eleventh grades, is designed to build on the Approaching Algebra Numerically (AAN) by using graphing calculators and the "Grapher," a computer program developed by Ohio State University.

3) C^2PC, The Calculator and Computer Precalculus Project for twelfth graders - This project uses graphing calculators and computer software to enhance the teaching and visualization of functions and limits.

4) Transitions - A mathematics course for twelfth graders who test poorly on the Early Math Placement Test and have a history of poor grades even though they have completed three years of mathematics. This course will correct deficiencies in mathematics skills and will help reduce the need for a remedial mathematics course in college.

Early Mathematics Placement Examination

During the eleventh grade, students will be given the Ohio Early College Mathematics Placement Test. This program is designed to provide students with an assessment of their present mathematics skills in arithmetic and algebra which will help them to help chart career plans as well as to determine whether they need to make course changes in the twelfth grade in order to prevent placement in a remedial mathematics course in college.

NSF Problem Solving Infusion Project

C^2ME is submitting a proposal for The Problem Solving Infusion Project to NSF in July, 1987. According to The Underachieving Curriculum: Assessing U.S. Mathematics from an International Perspective, students in the U.S. are severely deficient in mathematical problem-solving ability. The focus of C^2ME's four-year project will be to develop and implement a curriculum and professional development model which will upgrade the Cleveland Public Schools seventh- and eighth-grade mathematics curriculum to incorporate problem solving. The Problem Solving Infusion Project will: 1) establish an accurate working definition of problem solving and convey the integral relationship of problem-solving and mathematics to the Cleveland Public Schools' intermediate school teachers, 2) develop a format for the presentation of problem solving activities that will aid teachers in the development of problems and in the incorporation of problem solving into the classroom, 3) produce a set of teacher-developed problems correlated to the course objectives that will then be tested in an urban setting with a predominantly minority school population, 4) develop and implement a staff development model that will assist teachers in using new curriculum materials and in expanding their teaching techniques, 5) develop a problem-solving community computer network that will facilitate networking and aid in the formulation and dissemination of curriculum materials, and 6) establish a contest format that can be implemented in districts throughout the country. This grant will provide a unifying factor to many of the programs, such as the Oberlin Problem Solving Workshops, the Energy Problem Solving Project, and MATH REP. NSF will make its funding decisions in January, 1988.

Energy Problem Solving Project

As part of an effort to teach problem solving and to update the consumer math curriculum, C^2ME has submitted a proposal for the Energy Problem Solving Project to The East Ohio Gas Company. The project will: 1) plan and conduct a dinner symposium for math teachers that will provide a first-hand look at problem-solving applications and convey the integral relationship of energy, problem solving and mathematics; 2) develop a format for the presentation of problem solving activities that will aid teachers in the development of their own problems and in the incorporation of problem solving into the classroom; 3) develop and test energy-related problems correlated to course objectives; and 4) produce a notebook containing these problems to be used in Cleveland and in school districts throughout the country.

The Aetna Math Club Program

C^2ME will be submitting in the summer, 1987, a proposal to Aetna to help fund high school mathematics clubs. The funds will be used to grant $400 to participating schools to fund math club activities. An initial reception, early in the school year, will allow for questions of clarification, and for teachers experienced in this type of activity to share their knowledge. A main focus of club activities will be on problem solving. The main goals for this program are:

1) Support and invigorate math clubs and increase the number of clubs in the area;

2) Create and promote enthusiasm for mathematics among teachers and students;

3) Communicate to students high expectations for mathematics achievement.

4) Provide opportunities for teachers to test new instructional methods;

5) Provide multiple networking activities between teachers, between students, and among teachers and students;

6) Increase participation in mathematics contests;

7) Encourage teachers and minorities to be actively involved in the mathematics club;

8) Ultimately, foster an environment that will encourage student achievement.

SUMMARY REPORT:
DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Durham Mathematics Council for the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Durham Mathematics Council to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

DURHAM COLLABORATIVE: THE DURHAM MATHEMATICS COUNCIL

A. Purpose

The activities of the collaborative are guided by the five interrelated themes outlined in the proposal for refunding. These themes are:

1. The empowerment of teachers to determine the mathematics curriculum. The state of mathematics is rapidly changing, with a new emphasis on such topics as finite mathematics, statistics, and microcomputer applications. As technology continues to advance, the need to update the mathematics curriculum becomes more pressing. By encouraging and supporting mathematics teachers in their development of new curricula and methodologies and providing teachers with opportunities for professional growth and leadership, the council will empower teachers to play an influential role in the process of changing curriculum. By uniting teachers in a cooperative effort, the council will help them develop a stronger voice in future curriculum matters.

2. Involvement of teachers in decision making. Too often in the past, teachers have been passive agents in curriculum reform. Rather than partners in the process of change, teachers have been the recipients of change. If teachers are to become true professionals who impact on key matters such as curriculum, they must become involved in the decision-making process. Community recognition of teachers as experts in their field is a necessary condition for such involvement.

   In light of this, the council will develop activities to aid teachers in acquiring the expertise and leadership potential necessary to foster their participation in the decision-making process. The council will concentrate on developing high visibility and support from all areas of the community.

3. Council expansion to serve teachers throughout the Research Triangle area. The Research Triangle area (Durham, Raleigh, Chapel Hill) is rich in resources and in mathematicians. Expansion of council programs to involve teachers in this area will increase council visibility and status. This growth can be expected to enhance teachers' abilities to make change happen.

4. Impacting on curriculum at the state level. An increasing number of basic curriculum matters are being decided at the state level. If the council is to empower

teachers to affect change and to set the course of mathematics education, it must expand its focus to include the state level as well. The council must assist teachers in their efforts to become involved in state decision-making processes regarding such issues as curriculum, statewide testing, and textbook selection.

5. Development of a professional mathematics community. The council's highest priority involves easing the feelings of isolation and powerlessness experienced by mathematics teachers. The council will strive to develop a truly professional mathematics community in Durham, composed of mathematicians from all sectors. The council will work to combat the negative stereotypes expressed in such phrases as "...just a teacher...", as well as to develop a base of community support in order to demonstrate the value that Durham places on mathematics and education.

The goals implicit in these themes constitute a very ambitious undertaking. The council has identified four areas in which it must succeed if the collaborative is to become institutionalized:

1. The development of a secure resource base. Over the next four years, the council must develop strategies to secure a sound, stable financial base. If long-term goals are to be set, and if teachers are to be asked to make long-range commitments, then the council must demonstrate its financial security.

2. The involvement of teachers in the decision-making process. Traditionally, teachers have not been involved in policy decisions. The council must address the existing policy framework in order to develop strategies that will involve teachers in the decision-making process.

3. The development of a broad-based network. The council must develop strategies to educate members of the mathematics community about ways they can and should work together. Traditionally, barriers have existed among people in the university, business, and public school communities. The council must find ways to transcend these barriers and to demonstrate commonality of purpose among area mathematicians.

4. The establishment of ownership of the Durham Mathematics Council. The council must strive to develop a sense of community ownership. In order to survive, the council cannot be viewed as a Ford Foundation project, nor as a program of the North Carolina School of Science and Mathematics; it must be seen as a Durham project to improve education in Durham. If the anticipated geographic expansion does occur, then the project must be viewed as a program of the Research Triangle area. The

council will need to focus on strategies to develop this sense of community ownership.

B. Context

The community of Durham--which covers the city itself and large portions of the surrounding county--has a population of approximately 160,000; 105,000 of these reside within city limits. While the city and county maintain separate governments and operate their own public services, Durham is perceived as a single community, with its advantages and problems shared by all residents.

Durham is also the county seat and has been the county's only incorporated municipality since 1869. It is located in the geographic heart of the county and is the center for all social and cultural activities. In contrast, the majority of business and industry is located outside city limits, particularly in Durham County's portion of the Research Triangle Park. County boundaries surround more than 85 percent of the Park, which employs 22,000 people at an annual payroll of $700 million.

The Durham community is served by the Durham City and Durham County school systems. The geographic districting of these two systems does not conform to city and county boundary lines. The Durham County school system, for example, operates ten schools (seven elementary schools, two junior high schools, and one high school) within the Durham city limits. Similarly, a number of county residents live within the Durham City school district and attend its schools.

The Durham city and county school systems work together in a number of areas. The local summer school program is operated by the Durham City school system, but receives funding and students from both school systems. Recently, a number of high school English teachers from the two systems joined together to work with Duke University English faculty to develop individual curriculum projects. During the 1986-87 school year, the Teacher Express Program was launched, enabling teachers from both the city and the county schools to receive discounts of 10-20 percent at many community businesses.

Both the city schools and the county schools enjoy a good reputation locally and nationally and are committed to teacher excellence. For the second year in succession, a local teacher was named the regional teacher of the year. The Durham County System has required all of its teachers to enroll in effective teacher training between September, 1986, and June, 1988. The training involves attendance at ten three-hour sessions from 3-6 p.m. or 7-10 p.m., or a one-week summer workshop. Federally supported programs in remedial reading and mathematics have been approved by the Durham City School Board.

The Durham City school system, which serves a large minority urban population, operates under the leadership of Superintendent Dr. Cleveland Hammonds. In 1987, Dr. Hammonds was selected one of the top 100 educators in North America. A new assistant superintendent in charge of curriculum was recently appointed. Prior to the beginning of the 1986-87 school year, there was also a large number of principal reassignments; six principals and five assistant principals changed positions. Durham High was without a principal from June until October, 1986.

Slightly more than half of the city system's high school students were enrolled in mathematics courses during 1986-87. Students take an average of 2.5 mathematics courses during their high school years, and under a new program are required to demonstrate computer literacy as a prerequisite for graduation. The city offers seven levels of mathematics, from remedial courses through calculus, with class size averaging twenty-one students. About 63 percent of the graduating students enter some form of post-secondary education.

Larry Coble is the superintendent of the Durham County school system. The system's student population represents a mix of urban, suburban, and rural backgrounds, reflecting the broad range of lifestyles that exist within the county.

About 80 percent of the 3,914 high school students in the county system's three high schools were enrolled in mathematics courses during 1986-87. Students taken an average of 3.47 mathematics courses during their high school years, with class size for these courses averaging 24.5 students. Fourteen general, academic, and computer-oriented courses are offered, ranging from remedial mathematics to AP Calculus and an advanced mathematics seminar. Sixty-eight percent of graduates pursue some form of post-secondary education.

The county school district will adopt a K-5, 6-8, 9-12 structure within the next three years, a change that will involve a complete reorganization of the administrative staff, as well as the construction of new schools. During 1986, county voters approved a $38.4 million bond issue, paving the way for the construction of five new schools, and other building additions. It is anticipated that the first of these new schools will be completed by fall of 1988.

The State of North Carolina controls many aspects of education in the state, including teacher salaries, state textbooks, and career ladder. In 1986, the state increased teacher supplements and added supplements for new teachers. The state is currently working toward establishing a system under which all teachers would be required to follow a standard format in classroom performance. The state and its committees are not always receptive to having district input in making decisions on education in the state. In 1986, the governor appointed a statewide textbook review committee. This committee had the authority to designate the textbooks that could be used in the state. The committee rejected the offer from the Durham Mathematics Council to do some study of textbooks and to give the committee its opinion. The reason given was that the Durham teachers may be biased toward certain books. As a consequence, a summer workshop for Durham teachers to consider textbooks for adoption was cancelled.

The Governor has nominated Ms. Pat Neal, a member of the Durham County School Board, to the State Board, which supervises state-funded public schools. Ms. Neal's priorities include reducing dropout rates, raising teacher salaries, and improving buildings. She will provide a direct link between the Durham educational community and state policymakers.

C. Development of the Collaborative

Dr. Keith Brown, Dean of Special Programs and Research of the North Carolina School of Science and Mathematics, is project director of the Durham Mathematics Council. Dr. Jo Ann Lutz, who has a half-time appointment as collaborative director, also teaches mathematics at the North Carolina School of Science and Mathematics. Betty Peck, the on-site observer, is a mathematics teacher in the county schools.

The council found it very difficult to obtain commitments from local businesses for the matching funds required by the 1986-87 refunding proposal. Given the size of Durham, as well as the project administration's relative inexperience in fund raising, it is not surprising that the collaborative experienced problems in securing commitments. The Durham Mathematics Council has since developed a structure and a plan for fund raising and has sought assistance from persons experienced in the long-term planning necessary for securing needed funds.

An attempt is being made to link the fund raising activities of the Durham Mathematics Council to the new Durham Education Fund, which was established in 1985.

The Durham Math Council is led by a Board of Directors and a Steering Committee. The board is comprised of sixteen representatives from area businesses, higher education, and the city and county school districts, including two teachers. The board oversees the day-to-day functions of the collaborative. Five standing committees comprised entirely of board members were established in September, 1986, to aid in administering the collaborative affairs: the Executive Committee, the Nominating Committee, the Finance Committee, the Advisory Committee, and the Public Relations Committee.

The Steering Committee, which was initiated in 1985 and usually meets monthly, continues to play an important role in the collaborative. One teacher from each Durham school serves on the committee; these teachers were self-selected in that they were the first to return questionnaires indicating their willingness to serve. The Steering Committee serves as a conduit for information between the collaborative director and area teachers. Future activities are discussed at the meeting so that the committee members can report back to teachers at their schools what will be happening. In addition, the Steering Committee has fostered a strong bond among its teacher members, who have persuaded many of their professional peers to participate in council activities.

D. Relationship with Other Local Initiatives

The Durham Mathematics Council operates out of the North Carolina School of Science and Mathematics (NCSSM), a state-funded residential high school for academically talented secondary students. It is staffed with exceptional teachers.

The NCSSM Mathematics Department has received a Carnegie Corporation grant to design a course to replace precalculus in its curriculum. The new course will address students' need for more mathematics by exposing them to new mathematics topics while retaining the essential elements of precalculus for students who wish to go on to take calculus. The activities of NCSSM's mathematics staff offer special opportunities for teachers in the Durham Mathematics Council to be exposed to new ideas and to learn more mathematics.

On January 19, 1987, the Greater Durham Chamber of Commerce's Human Relations subcommittee sponsored a forum, "Building a Better Durham Through Education." Five DMC participants attended. The forum included discussion of collaboration between schools and colleges, curriculum content, and the centrality of teaching. Dr. Ernest Boyer, President of the Carnegie Foundation for the Advancement of Teaching, was keynote speaker.

E. Project Activities

During 1986-87, the Durham Mathematics Council sponsored several types of activities, all designed to provide teachers with growth experiences. These activities originally were conceived of as a "wish list" of projects developed with teachers during the council's planning phase. Only those activities in which teachers expressed an interest were organized and offered. These activities are described in the section "Council Sponsored Activities." In addition, the council supported activities sponsored by other agencies; this support included publicizing events and providing funds to allow Durham teachers to attend. These are described in the section "Council Supported Activities."

COUNCIL-SUPPORTED ACTIVITIES

In general, out-of-school networking activities were of four types: receptions and dinner meetings, industry tours, seminars and workshops, and internships and grants. In addition, during the 1986-87 school year the council established a Teacher Resource Center and facilitated the establishment of the Triangle Math Club. The council also continued to publish its own newsletter, which serves as an important vehicle for disseminating information.

Receptions and Dinners

During the 1986-87 school year, the Durham Mathematics Council sponsored several receptions and dinner meetings. These events were designed to provide an informal setting in which teachers and mathematicians from supporting institutions could meet and socialize. They also provided a forum for disseminating information about the council.

Math Council Reception. On December 9, 1986, the Durham Mathematics Council hosted a reception for all area mathematics teachers to highlight the council's fall activities. The event, held from 4-6 p.m. at Glaxo, Inc. at the Research Triangle Park, was open to all council members, including mathematicians from industry, and colleges and universities. Dr. Miriam Leiva, chair of the Department of Education and professor of mathematics at Davidson College, spoke on, "For the Love of Mathematics." Her presentation detailed topics she uses to arouse the curiosity and spark the imagination of mathematics students. After the lecture, Glaxo sponsored a reception. Seventy teachers and several university and industry representatives attended. One teacher said, "Dr. Leiva reinforced my feeling that effective teaching is what I make it, not a checklist of procedures." Another expressed pleasure at the "opportunity to meet with people other than math teachers--let's have more events like this." Dr. Leiva noted that she was "pleased by the enthusiasm of this group," and that she would "like to see other areas with like organizations." Dr. Imogene McCanless of Glaxo, Inc., a member of the DMC Board of Directors, said, "I would have liked to have a math council when I was teaching."

Spring Dinner Meeting. The Durham Mathematics Council held a Spring Dinner Meeting on March 17, 1987, at Alexander's Restaurant in Durham. Forty-two persons, including nine members of the DMC Board of Directors, heard Steve Davis of the North Carolina School of Science and Mathematics speak on current trends in mathematics, and Kathy Lynch and Parthenia Burnette speak on their experience at the Exeter Computer Conference. One teacher noted that it was a "great opportunity to hear and be heard about what we are doing right and what we need to change" and added "I felt like a person--not a teacher." Another noted that "we were already converted but it was good to hear an authority say that we are right." A representative from Measurement Incorporated who is also a member of the Board of Directors stated, "I do believe seeds were sown, teachers were encouraged to experiment, and all of us had our eyes opened to the needs of this country as we prepare young people to think and solve problems in the twenty-first century." A representative from North Carolina Mutual Life said, "It is good to see teachers mingling with each other and us."

Recognition Ceremony. The first annual Recognition Ceremony was held June 4, 1987, at the North Carolina School of Science and Mathematics. Twenty-seven teachers received awards for their participation in mini-grants, conferences, and workshops funded or supported by the council. The program included a welcome by Charles Eilber, Director of the North Carolina School of Science and Mathematics; a summary of Durham Mathematics Council programs by Council Director Jo Ann Lutz, and presentation of awards by Michael Bunch, Chairman of the Durham Mathematics Council Board of Directors. Fifty-one people participated, including teachers, spouses, business representatives, a principal, and both math coordinators. A reception followed the program.

A representative of Duke Power Company commented, "I didn't realize quite how busy you have been." Mike Bunch stated, "We want all of you to know that we appreciate your hard work and accomplishments." A teacher commented, "It's exciting to find out what others had done--we have really accomplished a lot."

Industry Tour and Follow-up Session

On May 26, 1987, the council sponsored a day-long tour of the Lake Norman Power Plant to highlight for teachers the work of one major area company. Seven teachers attended the tour, which was hosted by the Duke Power Company, to hear presentations on the use of mathematics by hourly employees of the power company. The teachers were enthusiastic about the trip and the information provided, but found that one day was too short a time for the amount of information given. One teacher commented, "I can now tell my students that they must know how to solve problems using mathematics." Another said, "We were treated as if we were important, which we are. Good presentations. I now believe in nuclear power!" A third said, "The math was good--the applications were good. Duke did a P.R. job to convince us that nuclear power is good. I did not buy it!"

A follow-up session for teachers who wanted to earn professional development credit for the activity was held June 8, 1987. At this session, each of the five teacher participants presented a plan for using the tour as part of a lesson. Most indicated that they would use the material in motivational talks to students stressing the need for the topics taught in a general mathematics class.

Seminars and Workshops

During the 1986-87 school year, the council sponsored a variety of seminars and workshops. In general, workshops were designed to improve specific teaching skills and to provide teachers with activities they could take directly into their classrooms.

Algebra II/Precalculus Network. The Algebra II/Precalculus Network was established in spring, 1986. This series of seminars and workshops on teaching mathematics at the Algebra II level and above is designed to bring together teachers of Algebra II, Algebra III, Precalculus and Calculus to share ideas and to help one another with problems.

In September, 1986, a meeting was held to plan the program for the Algebra II/Precalculus Network for the 1986-87 school year. Although a representative from each school was invited, scheduling conflicts prohibited all but six teachers from attending. It was decided that the seminars would be open to all teachers, but that meeting notices would be sent only to those who had informed the council office of their interest. The Network meets at 3:45 p.m. on the third Tuesday of each month at the North Carolina School of Science and Mathematics.

Five teachers attended the school year's first Algebra II/Precalculus Network seminar on October 21. It was anticipated that the attendance would be higher, but many teachers were in meetings for a reevaluation project in which their schools were taking part. Pat Robbins demonstrated Apple software she had developed for an algebra and geometry question bank, and gave copies to all interested teachers. Other teachers at the meeting demonstrated some graphing programs for the Apple. All the teachers who participated found the activity extremely worthwhile. One teacher said, "As a first-year teacher, I learned a lot about much software I had never heard of." Another said, "Hands-on use of materials was very valuable." A third commented, "We were able to use programs others had tested and found useful." The teachers appreciated receiving copies of the programs that had been demonstrated.

The Algebra II/Precalculus Network met again November 18. Dan Teague, a teacher at the North Carolina School of Science and Mathematics, demonstrated MuMath, a computer program that does much of the math taught in the algebra curriculum. The demonstration was intended to stimulate discussion about the influence innovative software has on what (and how) content is taught in courses leading to and including calculus. The fifteen teachers who attended felt that the seminar was very useful. One teacher commented: "[The seminar was] interesting and thought provoking. Good discussion." Another said, "I was persuaded to at least open my mind to new possibilities. I see this coming, I hope that I'm prepared. At least I won't have too many old habits that will have to die hard."

Because the January meeting of the Algebra II/Precalculus Network was cancelled due to inclement weather, its program was rescheduled for February 5th. Verdrey Madzimoyo and Pat Morris, the two Durham teachers who had attended the computer conference at Phillips Exeter Academy in June, 1986, reported on a Precalculus Seminar. Eighteen teachers attended.

The Algebra II/Precalculus Network met again March 24, 1987. Wallis Green presented the business applications of mathematics she learned in classes at Duke's Fugua business school MBA program. Seven teachers attended, which was fewer than expected. The teachers present seemed to feel that more teachers would have attended if the seminar were held at a time when "less pressure was on teachers." One teacher noted that it "gave us an opportunity to see how what we teach is applied." Another stated that it was "good to share Wally's experience." A third teacher said, "I found out linear programming is really used!"

Geometry Network. A series of seminars and workshops addressing issues and techniques related to the teaching of geometry was also scheduled for the 1986-87 school year. In actuality, however, only one meeting was held because most teachers already were involved in one of the other networks. At that meeting, on October 1, Vivian Leeper Ford and Parthenia Burnette gave a presentation on the Geometric Supposer at the North Carolina School of Science and Mathematics. The activity was intended to introduce teachers to the Geometric Supposer, to provide training in its use, and to allow teachers to experiment with it. A videotape on using the program was shown, followed by teachers' hands-on use of the Geometric Supposer.

The fifteen teachers who attended enjoyed the program, and several participants stayed past adjournment to "play" with the materials. The on-site observer reported that there was "great enthusiasm on the part of those who were there." One teacher commented, "The film was brief and to the point, informative, and a good introduction to the Geometric Supposer. We were allowed 'hands on' use of the software." Another responded, "[I] learned a lot about something new and useful." Other teachers commented, "I would like to be able to borrow the materials to experiment with some students"; "The activity was adequately explained and [it] showed the utility of the program. More examples of the different types of areas of usefulness would be helpful; more time on the demonstrations." A volunteer lay person commented, "Excellent program, interesting materials; probably a good beginning for what can be done in the future for geometry by using computers." The county math supervisor said, "The series appears to be based on 'Discovery Teaching,' which I have always found to be very helpful in helping students to become more knowledgeable once they have mastered the techniques involved. Should be an excellent addition to any program using the areas covered by the Supposer."

On February 19 and 20, 1987, Richard Houde demonstrated the use of the Geometric Supposer in a workshop at Rogers Herr Middle School. All junior high and high school geometry teachers were invited to attend. Despite severe weather that caused schools to be closed that day, twenty-two teachers participated. One possible explanation for this higher-than-average attendance is that teachers may have been more comfortable participating in the workshop once they knew that they would not be missing their classes in doing so.

One teacher commented that it was "worth the trip through the ice to learn about techniques and software that we can use to great advantage." Another said, "the presenter was a real school teacher who recognizes our problems and our needs. The presentation was down to earth and practical." All five teachers interviewed by the on-site observer said they planned to use the material in their classes provided they could requisition the needed software.

Grades 6-9 Network. Responding to the requests of teachers of grades 6-9, an effort was made to form a Grades 6-9 Network. On March 25, five teachers and two DMC representatives met to discuss the possibility of organizing a Grade 6-9 network. Although those present believed that the effort was worthwhile, it was decided that considerable recruitment would have to be done in order to form a successful network. Verdrey Madzimoyo, Tonya Scott, and Kay Swenson, three teachers who had attended problem-solving sessions at the NCTM meeting in Charleston, S.C., shared their ideas and problem-solving hints.

Math Counts Seminar. On December 4, the council offered a seminar on the "Math Counts" program at the North Carolina School of Science and Mathematics. John Goebel, a teacher at NCSSM who has helped to develop national-level Mathcounts tests, talked about this year's special topic, which is functions, and shared his ideas about how to teach the concept of function to seventh and eighth graders.

All junior high mathematics teachers were invited, but due largely to conflicts with the reception for cooperating and student teachers at the University of North Carolina-Chapel Hill, only nine teachers attended. One teacher stated that it was an "excellent background for introducing junior high [students] to functions." Another said, "It's so nice to see energy and enthusiasm."

Workshop on Probability and Statistics. A two-day workshop at the North Carolina School of Science and Mathematics, held June 11 and 12, 1986, focused on topics to be used in the classroom or in helping students with research projects. NCSSM teachers presented morning sessions on materials for classroom use. The afternoon sessions were presented by Dr. Deborah V. Dawson, Assistant Professor of Biometry and Medical Informatics in the Department of Community and Family Medicine at Duke University Medical Center.

Thirty-seven teachers attended the conference, and they were unanimously enthusiastic about the program. One teacher commented, "The activity was certainly worthwhile. Gave knowledge we can use in classroom." Another said, "Super handouts--great problems--great notes. Can't think of anything we've done that I enjoyed more." Dr. Dawson also felt that the activity was very successful and said she "was impressed with the caliber of participants--their questions and interest."

Math in Applications Workshop. On February 12, 1987, a "Math in Applications" workshop was held at the North Carolina School of Science and Mathematics. The workshop focused on providing meaningful courses to third-year mathematics students who are not ready for the algebra/precalculus track. All general mathematics teachers were invited; eleven attended.

The on-site observer noted that this activity was "probably our most successful attempt to 'connect' city and county teachers." One teacher commented that the strength of the session was in "the sharing of ideas among Durham City and Durham County teachers, high schools, junior highs and middle schools."

EQTEC Workshops. On March 13, a workshop on EQTEC--a program to encourage females and minorities in mathematics and computer use--was held at Neal Junior High School. Teachers Parthenia Burnette, Vivian Leeper Ford, Gloria Doyle, and Logan Wilkins shared what they had learned at the California EQTEC meeting. The sixteen junior high and middle school mathematics teachers who attended seemed surprised to discover that a mathematics background was not required for computer use. One teacher said, "We must begin to use what we learn to inspire our students, and stop using math to block access to computers." Another teacher said that the programs "opened eyes about how few women are in the field." A third said, "Very good workshop. I learned several motivating activities that I am going to use this year with my classes. I have already done one of the activities with my class."

On April 2 a follow-up to EQTEC was held at NCSSM. Seven teachers attended.

Seminar on Research Applications. On May 6, a seminar on the applications of mathematics and computers to research was held at the Research Triangle Institute. Twenty-two teachers attended the program, which consisted of four 90-minute presentations and a lunch provided by the Durham Mathematics Collaborative. The presentations included: Mathematics in the Development of Disease Transmission Models, Applications of Mathematics and Computer Graphics, Silicon Chips and Mathematics of Image Analysis, and The Mathematics Involved in Computer-Generated Random Digit Dialing.

While all the teachers present thought the seminar was valuable, some commented that the 90-minute presentations were too long. One teacher said, "The workshop showed how math ties in with research. This will be motivational for students." Another said, "very interesting, but not directly related to my area (level)." A third welcomed the "chance to enhance professional growth by being made aware of other career efforts" and said, "I think the Math Council is a very positive influence and hope that it will continue to offer educators seminars, workshops, etc.!" Although the seminar was primarily planned for senior high teachers, a number of junior high teachers attended. One junior high teacher who reported that the presentations were "over his head," was still able to recall several details from the presentations as well as his perceptions about how some of the presenters viewed mathematics.

A follow-up session for teachers who wished to earn professional advancement credit for the activity was held June 16. Each teacher presented a lesson plan based on the information obtained in the seminar. Since the program stressed the use of statistics and computers, teachers' plans dealt with precalculus and computer programming classes. Computer graphics was widely used.

Workshop on Teacher Effectiveness. On June 15, 1987, a workshop on techniques for organizing a mathematics class and using instructional materials in a time-efficient manner was held at the North Carolina School of Science and Mathematics. Nearly seventy persons heard a presentation by David Johnson, the chairman of the Mathematics Department at Nicolet High School in Milwaukee and author of the books "Every Minute Counts," and "Making Minutes Count Even More." Mr. Johnson provided tips on the art of questioning, efficient homework correction, and a practical notebook system, as well as suggestions for daily organization techniques such as getting started, connecting the lesson objective with past experiences, guided practice, and quizzes and test correction. Lunch was provided by the Durham Mathematics Council.

The workshop was very well received. One teacher commented, "It was the best workshop I ever attended. Lots of ideas that I can and will use. 'Methods' professors could learn a lot from Mr. Johnson as could our 'effective teaching' evaluators." A second teacher said, "Super program--wish it could have been longer. He spoke to every error I ever made and told me how to avoid repeating them. I intend to use many of his ideas--can hardly wait for

August to start." A third teacher noted, "Excellent, enjoyable. I wish administrators could all have been there to see what an effective teacher really does."

Internships

In 1986, the council initiated a summer internship program to secure summer internships in area industries for teachers who possess the requisite skills or interests. Teacher participants receive financial support and an opportunity to use their mathematical skills. During summer, 1986, the council coordinated an internship at Central Carolina Bank for one month, and another at the Triangle Universities Computer Center. This latter placement turned out to be more clerical than was expected.

The internship program was not as successful as had been anticipated. While there is considerable interest among teachers in the opportunity to work at mathematics outside the school, this enthusiasm has not been matched by the corporate sector. As a result this initiative was dropped from the 1987 summer program.

Grants

Grants Program. The Grants Program supports innovative efforts to enrich and strengthen mathematics curriculum and provides seed money for instructional experimentation and equipment. The council has informed teachers that curriculum grants of up to $300 are available to develop or purchase classroom materials. Grant applications are reviewed by the Advisory Board of the Durham Mathematics Council. The council's fall 1986 newsletter described the program and included an application form. In May, the Advisory Board reviewed four mini-grant proposals, ranging from $68 to $600, and four grant proposals, ranging from $433.85 to $2,200. The mini-grant proposals suggested purchase of materials to be used in the classroom, including a Family Mathematics video tape and color monitors. Most of the mini-grant proposals were submitted by two teachers, which meant that the actual funds requested were limited to a total of $600. The grant proposals were for compensation to do curriculum material development during the summer. The Advisory Board questioned whether collaborative funds should be used to purchase capital equipment and to whom the equipment would belong. All but one of the grants were approved; the board asked for more information on one proposal before giving its final approval. In addition to the grant proposals, the board approved funding the attendance of five teachers at various activities during the summer. Three teachers requested funds to go to Phillips Exeter Academy (two attended in 1986). Two teachers requested funds to go to the precalculus workshop at NCSSM.

Ultimately, the board approved five mini-grants, including one submitted after the May meeting for purchase of video tapes on Management Science and Statistics; three for developing curriculum materials during the summer of 1987; and one for attending a graduate course at UNC-CH.

Study Grants. The council also offers grants for university study in order to provide mathematics teachers with the opportunity to pursue advanced study in mathematics. The council will provide teachers with a stipend that will pay tuition, fees, books, and/or release time from one class. As of August, 1986, four teachers had been awarded grants for university study; one more teacher was awarded such a grant for summer 1987.

Information Dissemination

The Durham Mathematics Council Newsletter, published approximately every two months by the council office and sent to the home addresses of every secondary, middle school, and junior high teacher in the city and county school systems, is a primary tool for information dissemination. The newsletter highlights upcoming activities, and offers reports from DMC members (including teachers who have attended conferences) and a report from the council's executive director.

Teacher Resource Center

In the spring of 1987, a Teacher Resource Center was established in a space provided by NCSSM. The Center, which is open between 8 a.m. and 5 p.m. weekdays, provides teachers access to computers, software, and text and supplemental materials. The Center also serves as a workplace away from school. Center use by teachers has been less than expected, but efforts are being made to make more teachers aware of the Center and the services it provides.

COUNCIL SUPPORTED ACTIVITIES

In addition to sponsoring activities, the Council helped to provide funds for teachers to engage in professional activities offered by other agencies. These activities typically involve workshops and conferences, state and national professional meetings, and grants. These activities also involve helping teachers form a Triangle Mathematics Club of Mathematics in the area. Teachers are encouraged to find ways to share their experiences and ideas through council sponsored activities.

Triangle Mathematics Club

During the 1986-87 school year, the Durham Mathematics Council helped to schedule several events to facilitate the establishment of the Triangle Mathematics Club, an organization designed to involve mathematicians from all sectors and to promote the growth of mathematics and mathematics education. The club, which is modeled after the Greater Chicago Math Club, is expected to become self-sufficient, to have its own set of elected officers, and to establish regularly scheduled meetings. On December 2, 1986, eight teachers attended a meeting to discuss the organization of the club.

Kickoff Dinner. On February 24, 1987, the Triangle Math Club held a "dutch treat" dinner as both a kickoff activity and a recruitment meeting. Dr. Robert Silber of North Carolina State University spoke on "A Miscellany of Math Magic: A number of Effects based on Math and Logic with Applications." All Durham-area residents interested in mathematics were invited; thirty-eight attended including twenty-three teachers from the city and county schools and from Chapel Hill schools. Participants discussed the purpose of the Triangle Math Club and the kinds of activities and programs that would be of interest to the group. While the facilities were less than ideal (among other problems, there was a general power failure that lasted 40 minutes), most participants seemed to enjoy the evening. One teacher commented that it was enjoyable to meet a "non-teacher with interests like ours." A purchasing agent for Union Carbide Agricultural Products Company-Research Triangle Park commented, "The club is needed to help all of us interested in mathematics exchange ideas and get to know each other better." Many said that they looked forward to the next meeting.

Planning Meeting. On April 14 a planning meeting for the Triangle Math Club covered such topics as governance and long-term planning. Results of a survey among interested parties were mailed out prior to the meeting.

Dinner Meeting. A dinner meeting of the Triangle Math Club was held May 26, 1987, at T. K. Tripps Restaurant. Dr. William Love of the University of North Carolina at Greensboro spoke on "Infinity--The Twilight Zone of Mathematics." Forty-two club members, including twenty-five teachers from the county, city and Chapel Hill schools, attended. The presentation was well received, although there were a few negative comments regarding the physical facilities. One teacher said, "I often get discouraged--evenings like this cheer me up--I can go back to class and try again." Another said, "The Triangle Math Club has long been needed. A good evening with people of like minds who enjoy and respond to a challenging presentation. Thank you DMC." A purchasing agent for

Rhone-Poolenc said, "I was surprised to find that I followed and enjoyed the presentation. Enjoyed the group as well." A member of the collaborative said, "It was a very good meeting. The Club has great potential for meeting our goal of collegiality."

Workshops and Conferences

During the 1986-87 school year, the council supported teacher attendance at a variety of workshops and conferences. In exchange for council support to attend out-of-state workshops, teachers were expected to make presentations to share some of their new knowledge with other Durham teachers.

Family Math. In January, 1986, the council funded three teachers to attend a Family Math Instructors Training Workshop at the Lawrence Hall of Science in Berkeley, California. Family Math is a project of the EQUALS program that helps parents to become involved in their children's mathematics education.

These three teachers conducted workshops for other Durham teachers and parents, and organized Family Math programs at their schools, inviting parents and children to come to school one evening each week to participate in hands-on mathematics activities. One teacher was pleased with the attendance and results of a one-night session she had organized for parents and students. She observed that parents of lower-achieving students came with the expectations of helping their children do better, and that parents of high-achieving students came to help their children reach their high expectations. It was her impression that the parents of the average achievers did not attend. The three teachers also presented a workshop at the North Carolina Council of Teachers of Mathematics Conference in Raleigh on October 17, 1986.

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy. In June, 1986, five city and county teachers received support to attend this six-day conference on computers in secondary school mathematics. Three of the teachers received funds from the council, and two from the Technical Assistance Project at the Education Development Center. The conference, held at Phillips Exeter Academy in New Hampshire, focused on the impact and application of the computer on the curriculum. One teacher who attended commented: "The Exeter Conference was terrific. It was well-planned and well-organized. The facilities were beyond my imagination. This was truly a delightful week of learning and fun." Teachers who participated in the conference will lead seminars during the year in which they will share ideas from the conference with other Durham teachers.

Two county and one city teacher received funding to attend the 1987 computer conference at Phillips Exeter Academy held on June

21-26, 1987, which focused on computer use in the mathematics classroom. Two of the teachers had attended in 1986. It is expected that these teachers will make presentations to Durham teachers about the ideas and activities they garnered from the workshop.

EQUALS in Computer Technology. In August, 1986, the Durham Mathematics Council awarded grants to four teachers to attend a five-day program sponsored by the University of California-Berkeley. The program, designed for teachers, counselors, and administrators serving grades K-12, focused on attracting and retaining women and minority students in computer education. The program was geared for both the beginning and the experienced computer user.

All four teachers who attended (three females and one male) felt that the activity was very worthwhile and that it had "great value for those who use and maintain computers." One teacher said, "I have had the opportunity to attend several workshops. . . . I must admit that I have never participated in one so challenging, inspiring, applicable, and interesting as the EQUALS workshop. It was well-planned and well-presented. We were presented with a model team-teaching situation and learned so much in so little time, it was remarkable!" The four teachers shared what they learned by organizing and presenting the EQTEC workshop for other Durham teachers on March 13, 1987.

Logo Workshop. The DMC sponsored one teacher's attendance at a two-day Logo Conference in Arlington, VA, on April 2-4, 1987.

Professional Meetings

NCCTM Meeting. The NCCTM meeting was held on October 17-18 in Raleigh, North Carolina. There was no need to allocate funds to teachers for this meeting because Raleigh is only 20 miles from Durham. Furthermore, the Friday of the meeting coincided with a scheduled workday of release time for teachers of both districts. At the NCCTM meeting, the three teachers who had attended the Family Math Workshop at the Lawrence Hall of Science in Berkeley, California, presented a workshop on Family Math. In addition, one Durham teacher attended a regional NCCTM meeting in Charlotte, North Carolina, on March 6, 1987 and three teachers attended a NCCTM regional conference in Greensboro, North Carolina, on March 27, 1987.

NCTM Southeastern Regional Conference. Four teachers from both city and county schools received stipends to attend the NCTM regional conference in Charleston, South Carolina on November 13-15.

NCTM Annual Meeting. In April, 1987, the Council sponsored five teachers' attendance at the annual meeting of the National Council of Teachers of Mathematics in Anaheim, California. The teachers, who would not otherwise have had the opportunity to attend the meetings, received funds for both travel and expenses. Each teacher was also granted release time by the school district as the district's contribution to the council. All five teachers were unanimous in their praise for and appreciation of the conference.

F. Observations

The Durham Mathematics Council has progressed in several areas of primary interest to the Urban Mathematics Collaborative project. These areas include: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

During the 1986-87 school year the management of the Durham Mathematics Council remained in the capable hands of Keith Brown and Jo Ann Lutz. A clear delineation of responsibilities has been drawn between the DMC's Director and Executive Director. Dr. Brown sees his primary responsibility as setting the council's general policy direction. He is responsible for writing the proposal for funding from the Ford Foundation; overseeing fund raising; interacting with the Ford Foundation, the Technical Assistance Project, and the Documentation Project; and, initially, identifying key people to serve on the Advisory Board. (The Nominating Committee of the board now handles this latter responsibility.) Dr. Lutz, as Executive Director, is primarily responsible for the day-to-day operations of the council, and for interacting with teachers and board members. Dr. Lutz is assisted by Barbara Davis, the Math Council secretary. Ms. Davis, who is very knowledgeable about council activities, is able to answer questions about the Resource Center and to attend meetings when Dr. Lutz is not available. It should be noted that the Math Council secretary's role extends beyond the organization's administrative or clerical requirements; the fact that the phone is always answered has proven to be of great importance in establishing contacts with teachers.

Management of the DMC has evolved into a smoothly operating system. The complementary styles of the director and executive director contribute to this cohesive professional environment. Dr. Brown thinks it is important to identify good people and then step back and let them do what they are good at doing. His presence is felt in the council's well-defined vision, and in its explicit definition of long-term goals. Dr. Lutz works through the Advisory Board and Steering Committee to help make things happen. Initially, she was more directive with these groups in order to provide them with necessary input about the council's direction and goals. Now she primarily operates as a committee member and takes direction from the groups for developing activities. Drs. Brown and Lutz share a vision of teacher independence and decision-making to be accomplished over the next five years.

A second reason for the successful evolution of the collaborative involves the redefinition of the board structure. After several board members failed in 1986 to meet their commitments to seek out and develop funding resources, the membership and structure of the board was changed. Dr. Brown identified a single individual to be responsible for the council's finances, and the board was subdivided into five committees, each of which addressed a specific function. The committee structure seems to have been successful in maintaining the interest of board members and generating advice and direction for Dr. Lutz.

A third reason for the smooth operation of the collaborative is Dr. Lutz' ability to make things happen. A great deal of her time is devoted to overseeing arrangements for activities and meeting with teachers. She makes an effort to visit each of the fourteen schools to talk with mathematics teachers on a regular basis. In the fall of 1986, Dr. Lutz and her secretary visited each school to generate support and enthusiasm for the council; teachers' response was overwhelmingly positive. These personal contacts and the energy Dr. Lutz expends are viewed as important reasons for the variety of activities and the high level of teacher participation in the council.

The Steering Committee has become a primary source for activity ideas and for disseminating information to each school. This group has worked well as a conduit for communicating information to all teachers in the districts. Teachers who have served on the committee have valued the experience of influencing the council's activities and direction and of meeting regularly with their peers. The process for changing committee membership became an issue at the close of the 1986-87 school year. Although committee members agreed that as many teachers as possible should have the experience of serving on the committee, current members were very reluctant to give up their own participation. The issue of how the commitment of this group will be expanded to include other teachers remains a concern.

Development of the refunding proposal provided an opportunity for the council to propose a shift in its strategy for helping mathematics teachers. During the initial phase of the collaborative, a menu (or wish list) was prepared. When teachers expressed interest in a menu item, the council either sponsored an event or supported Durham teachers' participation in events conducted by others. This strategy proved of considerable value in counteracting teachers' sense of isolation from each other and from the issues and problems of mathematics and mathematics education. However, a shift in strategy is now being contemplated. While continuing to sponsor and support a variety of activities, the council will now begin to focus its efforts on three fundamental issues:

1. the development of new topics for the fourth year of mathematics;

2. the integration of technology into the classroom; and

3. the application and transferability of mathematics.

Program activities that focus on these issues must receive positive response from teachers, must be flexible and innovative, and must be broad based enough to appeal to a wide range of mathematics teachers. It will be interesting to follow the development of these focused activities and their impact on mathematics teaching over the next several years.

COLLABORATION

The strength of the Durham Mathematics council stems from two sources: the support from the "high tech" industries in the area, and the mathematical and educational background of the staff of the North Carolina School for Science and Mathematics. The teachers at the school are knowledgeable and current on the issues related to school mathematics, and they are active in dealing with those issues. At the same time, they are classroom teachers who deal every day with high school students. The council will continue to build upon these strengths.

Members of the Steering Committee work well together and support one another. This committee, comprised solely of teachers, feels that it brings the teacher's viewpoints and insights to the collaborative. The council provides opportunities for teachers from both the county and city schools to interact with one another.

While representatives of all sectors participate in the council, teachers comprise the majority of its membership; those from outside are viewed more as resources. To date, the council has involved mathematicians from industry by inviting them to present or to share ideas with teachers. Although these industrial activities have been well received, there is some concern that this contact has been primarily the corporate sector lecturing to the teachers rather than an interaction between those from each sector. It appears that the two sectors (corporate and teachers) are not interacting with equal status; the corporate sector seems to be "giving" while the teachers are "receiving." One teacher from Junior High said that he "felt dumb" after listening to all the mathematics that he had heard about at the RTI seminar. Nonetheless, despite the perception that teachers have been on the receiving end of this communication, some barriers have been broken. Some of the teachers have begun to feel comfortable in contacting the speakers and asking them to address another group of teachers or their students, or to have their students visit the industries. The council has been less successful, however, in involving university mathematicians. The establishment of the Triangle Mathematics Club could be an important step in building these collegial relationships.

The Council Board provides another opportunity for some teachers to interact on an equal basis with representatives of the business/corporate sector, university faculty, and other teachers. The meetings include a real interchange of views, opinions, and ideas. The experience of the two teachers on the Advisory Board seems to be very positive, and their opinions are valued as highly as are those of others.

Collaboration has also developed among teachers through their participation in activities and on the Steering Committee and between teachers and Dr. Lutz. In general, teachers feel very comfortable talking to Dr. Lutz and asking her for help or working with her; this interaction suggests sensitivity for the concerns of the teachers. For example, the teachers at Jordan wanted to develop an activity focused on probability and statistics. After they expressed this interest to Dr. Lutz and the Steering Committee, the DMC sponsored a workshop.

The DMC is involved increasingly in interactions with other collaboratives: teachers have attended summer sessions at Phillips Exeter with teachers from other sites; they have traveled to Berkeley's Family Math Workshop where they interacted with teachers from several California cities; the Philadelphia Mathematics in Applications Course has been discussed at a DMC activity; and teachers have attended professional meetings around the country.

Dr. Brown and others are aware of the importance of working with the state since many educational policy decisions are made at the state level. It must also be noted that there have been no problems with the administrative staffs in either school district and, in fact, the collaborative has worked with both school systems to meet some common goals. For example, the county is using a state grant to pay the salaries for teachers to attend the Woodrow Wilson seminar on probability and statistics; DMC is paying their expenses. Also, the county district is paying several teachers to work on other curricular projects during the summer of 1987, including one teacher who will do a project using a textbook by Saxon with an intermediate class.

As the focus of the council shifts to curricular changes in the next two years, it will be interesting to note the support and the impediments that may emerge. This is of particular importance in light of North Carolina's approach to effective teaching and assessment. Efforts to meet the state's demands could influence the perceived needs of teachers, and hence the character of council activities, especially as teacher input increases.

TEACHER PROFESSIONALISM

Although Durham teachers are not unionized, there is a very strong individual school building "work place" mentality among area teachers. Furthermore, due to the lack of a local professional organization, mathematics teachers have been very isolated from one another and from the issues and trends in the field. Collaborative activities have lessened this sense of professional isolation for many teachers. However, a large number of teachers in the area have yet to take part in any council activities. It should be noted that an initial differential in levels of involvement between county and city teachers is disappearing. A core group of participants, particularly those who serve on the Steering Committee, is emerging. These teachers form a solid base from which to draw other teachers into activities.

Dr. Lutz observes four changes in teacher behavior that she attributes in large part to the work of the collaborative. They are:

1. an increased awareness of the value of DMC activities;
2. a greater use of the DMC as a resource in supporting professional activities by teachers, both locally and at other locations;
3. a change in the way many teachers view themselves and their capabilities; and
4. an increased valuing and use of networking, i.e., using council members as resources.

As Dr. Driscoll of the Technical Assistance Project noted, while individually these changes may appear modest, collectively they signal a group developing its own sense of community. The next step, as Dr. Brown points out, involves teachers transforming themselves into change agents--no small feat in an environment as traditionally stable as Durham.

Teachers in Durham, and in North Carolina in general, work in an environment in which the state either maintains or is taking control of several key aspects of their professional lives: salary, state textbook lists, and, in the near future, career ladder. Overtly, it appears that teachers take this centralization for granted. They complain about low salaries (beginning at $16,000 and increasing after nineteen years to $28,000), but do not feel they can do anything to improve them. On the other hand, teachers from Durham have challenged some of the processes employed by the state, including the operation of the textbook selection committee. In addition, the state affiliate of the NEA maintains a strong political interest, lobbying the General Assembly in Raleigh, and lending endorsement to candidates for key offices.

There is more teacher freedom than would first appear to be the case. For example, the state prepares a list of textbooks from which schools make their choices. Other texts may be chosen as supplements. Teachers are granted a good deal of discretion in terms of the extent to which they use the primary and supplementary texts.

Teachers have also questioned some of the state mandates and the workability of some state requirements. The possibility exists that DMC activities will count for career ladder credit, if the program is enacted.

Another development initiated by the council in 1986-87 was the establishment of the Triangle Mathematics Club, a professional mathematics organization that would serve teachers from areas outside of Durham. Teachers have come to recognize that the absence of a local professional organization has inhibited their professional growth; the club could become an affiliate of NCTM and may involve mathematicians from all sectors. Those in attendance at the organizational meeting on December 2, 1986, at the North Carolina School of Science and Mathematics agreed that such a club was a good idea, that the council should help establish the organization, and that the club should sponsor dinner meetings with quality speakers. All high schools but one were represented.

The very existence of the DMC as an organization designed to serve and help teachers has made Durham teachers feel more professional. One teacher said, "Just think: they are trying to do something to help with my work." As plans for the club's organization developed, Dr. Lutz deliberately stepped back to allow teachers to take the lead. She sees the club as related to and partially supported by DMC, but not as a DMC activity. Betty Peck, the on-site observer, is one of the prime movers behind the effort. Some DMC money will be available if the $10 annual dues do not cover the expenses for next year, and the teachers do use council resources and the council secretary to send notices of the meetings. The club met in February, April and May. The first meeting had 45 participants.

The collaborative has developed in teachers a recognition of their collective expertise, and has provided a peer group in which teachers may consider themselves a part rather than as professionals working in isolation. The teachers seem to be supporting each other and getting ideas from the interaction. Teachers who have participated in Family Math, in EQTEC, and in Phillips Exeter programs, for example, have directed activities for their peers. Mrs. Betty Peck, the on-site observer, was invited to talk with teachers at a meeting at Hillside High School. One teacher said that she is the only one who teaches calculus at the school and appreciates the opportunity to talk to other calculus teachers at the Steering Committee meetings.

It should be noted that one impact of the DMC has been teachers' increased participation in professional conferences and meetings. Through DMC, teachers have traveled to Exeter, Berkeley for Family Math, NCTM (D.C. and Anaheim), and attended courses at Duke and UNC.

The council's activities to date exhibit an interesting mix of paternalistic events offered by outsiders and a "choice" mechanism that allows teachers to select from a menu those activities in which they wish to participate. The expectation is that this strategy will nurture the development and maturation of a truly professional group of mathematics teachers.

Teacher participation in council activities increased in 1986-87 over the previous year. During the year, 69 percent of the county teachers participated in a council activity, compared to 56 percent in 1985-86. Seventy-four percent of city teachers participated in at least one council activity in 1986-87, as compared to 68 percent the previous year.

There is some concern, however, that participation in council activities has decreased among some teachers due to the implementation of new school programs in the 1986-87 school year. All county teachers are required to take "Effective Teacher Training" in either 1986-87 or in 1987-88; as noted earlier, this will require attendance at ten three-hour, after-school sessions. In addition, three schools will conduct self-evaluation and reevaluation studies for Southern Association. It is feared that this effort will be extraordinarily time consuming. Many Durham teachers do not want to miss classes to attend council activities during school hours; additional commitments during after-school hours may therefore impact on attendance at council activities. This possibility must be monitored carefully, as there is considerable work pressure on the teachers served by the DMC. The "effective teaching" sessions at night and the number of schools preparing for evaluation create an environment in which the collaborative must be sensitive to the concern that its activities may contribute to burnout if care is not exercised. This is a real concern, and it raises an important issue. On the one hand, its status as a collaborative requires that the council make real demands on teachers' time and intellectual capabilities. At the same time, however, it must not be so burdensome that it works against, rather than for, the participating teachers.

MATHEMATICS FOCUS

The mathematics focus of the Durham Mathematics Council seems eclectic. One strong emphasis involves existing curriculum and helping teachers to know more about instruction in those content areas. This is achieved through teachers networking with other teachers. At the same time, the collaborative makes efforts to introduce less traditional school topics such as probability, statistics, problem solving, and applications. These topics have received attention by some teachers in the council through workshops, seminars and mini-grants.

A stratification of teachers exists according to the topics they can teach. Some teachers only feel comfortable in teaching courses through Algebra I, while others feel more comfortable teaching geometry. Dr. Lutz has encouraged teachers to attend the NCSSM precalculus summer workshop to help update their knowledge in more advanced mathematics.

The use of computers and technology in the schools depends upon the interest of individual teachers. Computers are more apparent in the county schools and appear to be used more often than they are in the city schools. Computer use has not been a topic of great interest to a large number of teachers.

The NCSSM has been very influential in keeping some teachers current on new developments in mathematics education. The school received a three-year grant to pay for teachers from around the state to teach at the school for one year. During this time new approaches were tested and new topics in mathematics were explored by the visiting teachers. In a few cases, teachers who came from other parts of the state chose and were able to acquire a job in the Durham area upon completing their year. These teachers, along with the few from Durham who were visiting NCSSM teachers, provide a cadre for building on some new ideas about mathematics teaching.

G. Next Steps

The collaborative will continue to offer teachers the opportunity to participate in industry tours, seminars, conferences, and workshops, and will ask participants to report back to their colleagues about their experiences. During summer, 1987, the collaborative will sponsor teachers to attend the NSF funded workshop on the precalculus curriculum at the North Carolina School of Science and Mathematics, a related workshop on contemporary topics in precalculus, and a Woodrow Wilson Institute on mathematical modeling.

Workshop on the Precalculus Curriculum Project at the NCSSM

The North Carolina School of Science and Mathematics has received funding from the National Science Foundation to run a 12-day mathematics workshop for selected teachers from nine of the eleven mathematics collaboratives established by the Ford Foundation. The workshop will be held July 6-July 17 at the Research Triangle Institute in Durham, and will focus on the precalculus curriculum development project underway at the North Carolina School of Science and Mathematics; more explicitly, the workshop will cover applications of elementary functions, including elementary data analysis, modeling, algorithms, and the use of a computer in instruction. Each teacher will receive a stipend. Each team of teachers is expected to assist in reviewing materials to be used in in-services for teachers of grades 7-12. The team will conduct a one-week workshop during the summer of 1988 in their home district for teachers of grades 7-12.

The workshop has three practical goals:

1. to acquaint teachers with the goals of the syllabus under development at NCSSM and to prepare teachers to be able to use some of the units in their teaching;

2. to familiarize teachers with recommendations about the secondary mathematics curriculum, focusing on the need to introduce new topics such as finite mathematics, data analysis, algorithms, and the need to make more effective use of computing in the classroom; and

3. to prepare teachers to conduct one-week workshops that address the recommendations in their home districts during the summer of 1988. The workshops will be based on a set of materials developed at NCSSM during the 1987-88 school year.

Thus, each participating teacher will help test the newly designed programs that reflect the recommendations to improve the secondary mathematics curriculum, provide suggestions for improving the units after their use in the classroom, assist in the design of teacher training materials for acquainting teachers with recommendations for improving mathematics instruction, and help conduct a workshop for fellow teachers.

The project's primary goal is that participating teachers will experience a special professional opportunity, one which results in growth and a greater involvement in mathematics education. The Durham Mathematics Council has been asked to sponsor five teachers, one from each high school, to attend the workshop.

Contemporary Topics in Precalculus at NCSSM

During the past two years, the mathematics faculty of NCSSM has, under funding by the Carnegie Corporation of New York, developed a syllabus for fourth-year college preparatory mathematics. The new syllabus incorporates recommendations about the secondary mathematics curriculum from such organizations as NCTM, MAA and NSF, and includes such topics as data analysis, algorithms, and the need to make more effective use of computing in the classroom.

The collaborative will fund four DMC teachers to attend the workshop, which will be held July 13-24. The workshop will acquaint teachers with the goals and topics of the syllabus under development at NCSSM, with emphasis on those topics that are generally considered new to the more traditional "precalculus" course and on the use of the computer as a tool in classroom instruction. After participating in the workshop, teachers will be prepared to use some of the new units in their own classrooms.

Mathematical Modeling Residential Institute

Two teachers, one from NCSSM and one from the county, will receive collaborative funding to attend a Woodrow Wilson Institute for teachers of secondary school mathematics at Columbus College, Columbus, Georgia, on July 25-31, 1987. The four-week residential institute will be open to high school mathematics teachers with three years of experience and continuing employment. Fifty teachers from across the country have been chosen by competition to attend. The institute will focus on mathematics modeling using discrete and other school mathematics. It is anticipated that the two collaborative teachers who attend will present a workshop for teachers from across the state in summer 1988.

Other Plans for 1987-88

During the 1987-88 school year, the council also will continue to make funds available for teachers to visit schools with model programs. As in 1986, grants will be offered to teachers for classroom improvement. The Study Grant Program, which encourages teachers to pursue university study, also will be continued.

The collaborative plans to schedule several dinner meetings during the 1987-88 year. These meetings will feature an invited speaker who will discuss relevant topics in mathematics and mathematics education, and will provide a forum for teachers to present results of their projects. The Council is also beginning to explore the use of cable television as a means of serving the entire mathematics community.

The Math Council is in the process of establishing a teacher Resource Center. The center will include a test bank organized by teachers, textbooks for review, and computers and software to test. The DMC Resource Center will be located at NCSSM, next to the Math Council Office. Teachers are being encouraged to help organize the center.

In June, 1988, the Durham Mathematics Council and the North Carolina School of Science and Mathematics will host a national mathematics conference on the theme "Teacher Professionalism: The Role of the Mathematics Teacher." Experts from across the nation will be invited to speak. Topics will include changes in curriculum, the state of the mathematics teaching force, and trends in technology and their effects on the role of the teacher.

SUMMARY REPORT
LOS ANGELES URBAN MATHEMATICS/SCIENCE COLLABORATIVE (LAUM/SC)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Los Angeles Urban Mathematics/Science Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Los Angeles Mathematics/Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; and five site visits by the staff of the Documentation Project.

LOS ANGELES URBAN MATHEMATICS/SCIENCE COLLABORATIVE (LAUM/SC)

A. Purpose

The Los Angeles Urban Mathematics/Science Collaborative is the official title of the thirty-five-member Advisory Committee to the Los Angeles Educational Partnership. This committee, established in 1986, was created from the consolidation of the advisory committees of the Los Angeles Urban Mathematics Collaborative and the Mathematics/Science Fellowship Advisory Board. The Advisory Committee currently provides direction to the Los Angeles Educational Partnership on the operation of four programs: +PLUS+ (Professional Links with Urban Schools), Mathematics/Science Teacher Fellowship, Science and Math Enrichment Program, and Target Science. The Advisory Committee was restructured in order to reduce duplication of committee memberships, and to bring together those concerned with mathematics and science education.

The goal of the +PLUS+ program of the Los Angeles Urban Mathematics/Science Collaborative is to use a mathematics resource network to assist teachers in relating the world of work to the mathematics curriculum. It is expected that teachers will benefit from expanded horizons and increased interaction with their colleagues. +PLUS+ activities during the 1986-87 school year included an expansion and continuation of those cited in the original funding proposal: networking and collaboration among teachers, mathematics departments, and mathematics resources were expanded from the community level to encompass state and national resources; team building and leadership skills for mathematics teachers were further developed; teachers were provided opportunities to develop, evaluate, and integrate new materials and methods into the curriculum.

It is anticipated that +PLUS+ activities will enable teachers to:

1. become a part of the mathematics resource community through interaction with mathematicians and their professional organizations;
2. perceive themselves as effective, empowered agents of the professional education community; and
3. discover new and effective ways to motivate students to study mathematics, which in turn will increase the number of students successfully completing high school mathematics programs and increase student awareness of the importance of mathematics.

B. Context

The Los Angeles Unified School District's K-12 enrollment increased by 11,000 students during the fall of 1986, to a total enrollment of 590,287. Nearly 155,000 of these students attend high schools or magnet schools. Nearly 14 percent of all California public elementary and secondary students attend Los Angeles schools, and the Los Angeles schools enroll 45 percent of all students in Los Angeles County.

The Los Angeles Unified School District employs 29,221 teachers in grades K-12 at an average annual salary of $30,337. About 79 percent of the district's $3 billion operating budget comes from state funds; 9 percent comes from local property taxes, 8 percent from federal funds, and 4 percent from other sources. The average cost of educating a Los Angeles school district pupil during 1985-86 was $3,402.09.

Enrollment for the 1987-88 school year is projected to increase by 15,000 students, the majority of whom will have limited English skills. Steady enrollment increases have pressured the superintendent and the School Board to develop a plan to address school overcrowding. In December, 1986, the School Board delayed for a year a decision to convert additional schools to year-round programs. Instead, the Board approved the addition of 265 portable classrooms, and transferred 9,000 students from overcrowded schools to schools with available space, changing the integration ratio from 60:40 to 70:30. The delay in converting to a year-round school program allowed more time for planning.

The district is also struggling to address a dearth of qualified teachers, especially in inner-city schools; teacher walkouts; and the potential disruption of new district leadership. Los Angeles lost many mathematics and science teachers when the courts ordered that faculty desegregation precede student desegregation; many teachers chose to leave the system rather than to relocate to inner-city schools. This has greatly reduced the number of experienced and qualified teachers, especially in fifty-five inner-city schools. As a result, these schools have been granted priority in hiring new staff. In addition, the district's requirement that mentor teachers be willing to change schools to help inexperienced teachers has caused many mentor positions to remain unfilled. The district has only four mentor teachers of mathematics in all of its junior and senior high schools, in spite of the fact that the state contributes an additional $4,000 to the salaries of mentor teachers.

The teachers' union in Los Angeles (an affiliate of NEA) is not very strong. Teachers' salaries range from $20,000 to $38,000, a pay schedule many teachers view as inadequate. To illustrate, teachers were discouraged to learn that the workers who change the combinations on school lockers receive a starting salary of $31,000 after only six weeks of training.

Finally, Superintendent of Schools Harry Handler resigned at the end of the 1986-87 school year, although he has agreed to serve as a consultant for one year to assist Superintendent Leonard M. Britton, who was appointed after a nationwide search.

C. Development of the Collaborative

The thirty-five-member Advisory Committee to the Los Angeles Educational Partnership, which constitutes the LAUM/SC, has been chaired since March, 1986, by Erwin Tomash, chairman of Dataproducts Corporation. The Advisory Committee is responsible for developing policy for the four mathematics and science programs administered by the LAEP. The Collaborative Advisory Committee is comprised of the lead teacher from each +PLUS+ school; Board of Education members; administrators and instructional specialists from the Los Angeles, Pasadena and Inglewood unified school districts, the El Monte Union High School District, and the Los Angeles County Office of Education; and representatives from foundations, museums, corporations, professional organizations, and postsecondary institutions. Selected members of the Board of Directors of the Los Angeles Educational Partnership also are invited to serve as ex-officio members of the committee. The Collaborative Advisory Committee meets as a whole two or three times each year. Peggy Funkhouser, Executive Director of the Los Angeles Educational Partnership, is director of the collaborative. The coordinator of the +PLUS+ program is Toby Bornstein. The on-site observer is Richard Curci, a high school mathematics teacher and a mentor teacher.

The Ford Foundation's Urban Mathematics Collaborative project funds the +PLUS+ (Professional Links with Urban Schools) program. Steering committees are designated as needed to plan and organize +PLUS+ activities. Teachers, business associates, and college associates who participate in +PLUS+ activities are considered program members. In April, 1985, the mathematics departments at three high schools were selected from a targeted group of forty-seven mathematics departments to form teams with representatives of business and higher education in order to strengthen mathematics instruction and build links to the world of work. A +PLUS+ team, including the participating teachers, two business associates, one university associate, and a facilitator, was formed in each of three schools: Manual Arts and Wilson High Schools in the Los Angeles Unified School District and Mountain View High School in the El Monte Union High School District.

Teachers' Council

During the 1985-86 school year, the Teachers' Council, a group comprised of teachers from the three +PLUS+ teams, was established to offer input on how the collaborative could best meet the needs of teachers. The group met occasionally during 1985-86 to share information about individual team activities. In spring, 1987, this group became the Teachers' Council, and membership was expanded to include representatives from other groups, including the California Mathematics Council and other eligible school districts. This expanded Teachers' Council met five times during the 1986-87 school year to define the group's mission and to establish a working structure.

The meetings also provided an opportunity for teachers to socialize with their school district peers and their colleagues from professional organizations. Early meetings were devoted to defining council priorities, which were identified as collaborative promotion, curriculum review, and internship development. Council members offered suggestions for activities, including networking, social gatherings, and workshops, and heard such speakers as Gene Maeroff, a consultant from the Rockefeller Foundation, address the issue of teacher empowerment. Finally, the five meetings represented a series of positive steps toward the development of an explicit definition of the purpose and function of the Teachers' Council.

Teachers' responses to the meetings were overwhelmingly positive and indicative of their solid commitment to the Council's continued development and success. One teacher commented, "I'm on the council for positive and permanent change. One thing that keeps me involved is seeing permanent change. While programs are in operation, we need to see things pieced together to help foster change. We need this council, but we have to define our roles. Today was a beginning." Another said, "In order to bring about change, we must share ideas and take them back to school and implement them. We need to access the decision policy makers. I never anticipated rubbing elbows with Les Winters, secondary LAUSD math director. I couldn't believe that I would meet the policy makers. +PLUS+ has allowed that to happen. This meeting helped clear things up for me." Other comments included, "I finally have an acceptable explanation of what the Teachers' Council role is and some of our responsibilities," and "I had no idea what the Teachers' Council did but this was helpful. We all seemed to be unclear; however, this brainstorming has shed some light."

At the group's fifth and final meeting for 1986-87, teachers were enthusiastic about the progress the council had made during its first year. One teacher commented, "We seem to be making headway. I never realized that it would take so long to get the ball rolling. Toby has been helpful, but we need to help her now." Another said, "We have met 3 or 4 times and we are making progress. Slow may it be, but progress. The council is a good idea. Just another way for us to keep in touch and find out what our schools are doing." A third commented, "This council could make a difference, but we need to get our act together. We have never done this before. I'm sure once we get focused we can accomplish something."

A major outcome of these meetings has been teachers' identification of the role of the Teachers' Council as an agent for curriculum change and the need to interact with curriculum decision makers in their districts. A subcommittee has been established to help implement change by developing a council structure as well as strategies for interaction.

Addition of New +PLUS+ Departments

During the 1986-87 school year, efforts were made to increase from three to eight the number of targeted mathematics departments in the +PLUS+ program. During the program's initial phase, teacher participation was voluntary and therefore varied significantly among the three schools. During its expansion phase, rigorous prerequisites for program participation were developed. In order to be selected as a new +PLUS+ department, 60 percent of the members of a department (including the chairperson) had to agree to participate in the development of the school's Action Plan, a proposal for a $2,500 grant that detailed the department's activities for the coming school year. Furthermore, the entire department had to endorse the programs outlined in the plan. The +PLUS+ program sponsored a series of meetings and activities throughout 1986-87 to stimulate interest and to encourage departments to apply to become one of the five new +PLUS+ teams.

October Orientation Meeting. To increase teachers' awareness of +PLUS+ activities, eleven school districts were invited to send representatives to a +PLUS+ orientation meeting on October 9, 1986. Nearly fifty people from seven districts attended. Thirteen of the twenty eligible high schools in the Los Angeles Unified School District and ten of the twenty-seven eligible county schools were represented. The program included an overview of +PLUS+, a description of a +PLUS+-sponsored fall workshop series, and a session in which teachers from the original +PLUS+ teams shared their experiences and answered questions. The meeting encouraged teachers to attend the upcoming workshops, exposed participants to collaborative activities, and helped to identify the needs of the various districts. Finally, the meeting was designed to stimulate departments' interest in being one of the five new high school mathematics departments to become a +PLUS+ team.

January Orientation Meeting. In January, 1987, forty-seven high school mathematics departments from eleven school districts were invited to apply to become one of five new +PLUS+ Mathematics Departments. Selection criteria included strong departmental leadership, cooperation of the site administration, sanction and support of the district, and commitment on the part of teachers to devote the time required to collaborate with colleagues. On January 22, 1987, an orientation meeting was held at Huntington Park High School to introduce representatives from interested departments to the +PLUS+ program and to disseminate application materials. Twenty-nine persons attended in addition to those presenting the program. Members of the original three +PLUS+ departments spoke on the opportunities available through +PLUS+, and how these opportunities had resulted in personal and professional growth, and offered an overview of the requirements and commitments expected of +PLUS+ departments. The +PLUS+ teachers from the original cohort schools did most of the talking, with Project Coordinator Toby Bornstein speaking briefly at the start and close of the meeting.

Participants at the orientation meeting seemed excited about the prospect of applying and particularly enjoyed the presentations by the original +PLUS+ teachers. One teacher commented, "+PLUS+ sounds interesting. It helps teachers directly. I enjoyed hearing teachers' comments." A principal said, "This is a program my school could benefit from and we will be applying. I'm glad I came."

The program planned to add five new departments, two from LAUSD and three from outside of the district, for a total of four LAUSD schools and four county schools. All interested departments, including those that had participated as +PLUS+ departments during the 1985-86 school year, were required to apply. Finally, eight schools, including two of the original +PLUS+ departments, participated in the process. The teachers and administrators from the schools were interviewed in March, 1987, by a committee consisting of the project coordinator, one teacher from a current +PLUS+ department, and one school administrator. One school withdrew its application during the interview process, after realizing it lacked the commitment critical to success. The remaining seven departments were selected for the training part of the program to develop a department proposal. Included in the seven departments were two of the three original +PLUS+ departments, Mountain View and Wilson School, and five new departments: Franklin, Jordan, Morningside and Venice High Schools, and Washington Preparatory High School. One of the original three +PLUS+ schools, Manual Arts, decided not to reapply for funding although it is giving consideration to participating in the spring 1988 workshops.

Leadership Meetings. On March 16, 1987, a Leadership Meeting was held at the LAEP office for department chairpersons and team leaders from the seven participating departments. The meeting was designed to help the department prepare for the proposal planning meetings scheduled in April and May. Fourteen persons attended, including two representatives from LAEP and two consultants hired by +PLUS+ to facilitate the successful assimilation of the new departments into the +PLUS+ program. At this meeting, participants reviewed the problems and accomplishments of +PLUS+ during its first year, discussed the role of a leader in +PLUS+, attempted to identify strengths, weaknesses, potential problems and solutions unique to their departments, and discussed the importance of achieving broad participation during the planning phase. Participants felt the meeting was very helpful. One person commented, "I enjoyed being here. We all seem to have the same kinds of political problems at our schools." Another appreciated the opportunity to meet together: "Sometimes we don't know who we are working with until we sit down and talk." One of the consultants noted, "Everything went as planned and I think it was successful. The leaders have a better understanding about the process. I was pleased at how well it went. We have a good group of leaders."

To assist the smooth introduction of the five new +PLUS+ departments, teachers involved in +PLUS+ during its pilot year were asked to serve as facilitators and discussion leaders at the April and May proposal planning meetings. Fourteen pilot teachers met with consultants on March 23, 1987 at the LAEP office to prepare for this role. Participants learned that the basic responsibility of a facilitator involved assisting group members to use their meeting time effectively and efficiently. Specifically, the pilot teachers were directed to encourage each person in the group to participate, to discourage individual domination of the group, to clarify the tasks at hand, and to keep the group on task and on time.

One teacher commented, "Knowing what the end results should look like helps. Using us [as facilitators] is an excellent idea. Glad to know we could help." Another said, "Too bad we didn't have this kind of help the first time around." One of the consultants added, "I'm pleased to see how helpful these teachers are and how open they are."

Proposal Planning Meetings

April Meeting. On April 4, 1987, the first of two +PLUS+ proposal planning meetings was held at the ARCO Towers in downtown Los Angeles. The meetings were designed to help both the new and the continuing +PLUS+ departments begin to develop their department plan, which would lead to the production and submission of their $2,500 grant proposals. Of the eighty +PLUS+ teachers invited, sixty-three attended. The program included instruction on identifying the mathematics education problems the +PLUS+ department would address, using problem-solving strategies to resolve these problems, setting priorities, and developing a proposal. Lunch was provided, and each teacher received a $50 stipend. Teachers active in +PLUS+ during its pilot year served as facilitators and group-discussion leaders.

Teachers in attendance were pleased with the workshop. One commented, "I'm glad I came. Bringing us together was a great idea. We share the same needs. We need to speak to the district as a group and let them know what we want. We certainly have the power right in this room." Another said, "Bringing teachers of the same subject together to talk was a great idea. My department and I learned some things about ourselves we didn't know. Now that's worth our time."

The consultants also were pleased with the results of the workshop: "I feel this was very successful and these teachers worked hard. I'm very happy with the way it went," one reported. A teacher who was active during the pilot year noted that "it was much better than Phase I. We have learned a great deal and it paid off."

Following the April meeting, Toby Bornstein visited each of the seven schools to ensure that the proposals would be finished for the May meeting.

May Meeting. The second meeting to help the departments refine their proposals was held May 2, 1987, at the Hughes Corporate Headquarters. Fifty-three teachers and seven Hughes or TRW representatives attended. Each department presented a first draft of its proposal, and the documents were reviewed and critiqued in small groups. Meeting leaders presented a role-playing demonstration that highlighted potential communication problems and poor problem-solving techniques in the context of a departmental meeting. Departments then met to rework their proposals and to discuss problem areas. Lunch was provided and teachers received a $50 stipend.

Teachers seemed to feel that the workshop was worthwhile. One teacher commented, "Today was a learning experience with teachers helping teachers. It was well organized. I learned from reviewing other schools' proposals about my department's proposal. The comments were extremely helpful." Another said, "Even though it's Saturday morning, I'm glad we came. This was so helpful and this facility is beautiful. We needed other input and the other schools gave it. We need more meetings like this. We are a new +PLUS+ school and so far it's been very supportive." A Hughes retiree commented, ". . .it's good to see teachers working together. This is a good process. Seems the proposals need more time to be thought out. I used to write proposals for Hughes, it meant my job. You can call me for help anytime." The on-site observer noted that the departments had progressed far beyond their counterparts of a year ago.

As a further aid to +PLUS+ departments, Judy Johnson and Dick Cone, the consultants hired by +PLUS+ to help departments with their proposals, visited each school during the proposal writing phase. Each site visit focused on the department's objectives and the generation of multiple strategies to achieve those objectives. This type of consultation will not be continued in future +PLUS+ program expansions, as teachers in general did not find it to be effective, and in fact, perceived the consultants as taskmasters.

June Meeting. Teachers from the seven +PLUS+ departments met at Morningside High School on June 1, 1987, to present their completed proposals and to hear the other teams' proposals. Twenty-two members of the +PLUS+ math departments attended. One teacher commented, "Even though we come from different areas, there are many similarities in our situations. Some schools sound like ours. Others are somewhat different. It was interesting to see the direction we each took for our plans." Another said, "I enjoyed hearing what the other schools are doing. I got some good ideas. We hope ours will be accepted. I think it is important we listen to each other." A third stated, "Listening to the way seven different schools run a math department was a lesson in itself. Everyone went away one step closer to their plan and each school had more respect for the others." LAUM/SC Coordinator Toby Bornstein reiterated the on-site observer's comment that the departments were "far ahead" of corresponding departments from the pilot year. She gave much of the credit to Dick Cone and Judy Johnson for helping focus the teachers' efforts.

Grant Review

A grant review panel met June 25, 1987, to make recommendations for proposal improvements and to suggest specific implementation strategies to the grantees. Grants will be awarded formally in the fall; recipients will then participate in an implementation retreat.

It should be noted that the new mathematics departments that were added to the +PLUS+ program are eligible to receive only one planning grant. This restriction was established to ensure that departments will not become overly dependent on outside funding and will more readily incorporate +PLUS+ activities into their regular procedures. (The three original +PLUS+ departments were exempted from this restriction during 1986-87).

The goals expressed in the departmental Action Plans varied for each team. A brief description of some components of the Action Plans is presented below.

DEPARTMENT ACTION PLANS

Because individual department Action Plans reflected the problems identified by teachers in each of the seven participating departments, they varied in focus and content. Mountain View High School, for example, addressed perceived problems of teachers' lack of knowledge about computers, students' lack of awareness of the relevance of mathematics in the world of work, and an unacceptably high failure rate by planning to provide release and in-service time for teachers to review computer software, developing a tutorial program for students, and inviting guest speakers from business and industry. Woodrow Wilson's Action Plan focused on enhancing computer use in the classroom, while Franklin High School, with a 42 percent dropout rate, has chosen to devote its resources to improving students' study skills and academic performance, both in mathematics and across the curriculum.

Other innovative strategies developed in the plans include Jordan High School's program to improve student attendance and increase student motivation by providing $1 reward coupons twice monthly to students who exhibit perfect attendance and improved achievement; Morningside's emphasis on acquiring such curriculum support materials as overhead projectors and manipulatives, and its planned development of a team-teaching approach; Venice High School's plan to establish a mathematics department office as a means of fostering department cohesion and cooperation; and Washington Preparatory High School's decision to introduce innovative teaching methods, hands-on laboratory experiences and guest speakers to stimulate students' interest in mathematics.

D. Relationships with Other Local Initiatives

A variety of institutions and organizations in the Los Angeles area serve as resources and offer professional opportunities for mathematics teachers. Both the Los Angeles Council of Teachers of Mathematics, of which the president-elect is a +PLUS+ teacher, and the California Mathematics Council hold annual meetings for mathematics teachers. +PLUS+ teachers not only attend these meetings, but are active participants who give presentations and provide leadership.

Institutions of higher learning also offer courses, institutes, and special programs in which +PLUS+ teachers can participate. In the summer of 1986, a +PLUS+ teacher attended a UCLA conference on the influences of testing on the mathematics curriculum, and four +PLUS+ teachers participated in UCLA's High School Mathematics Project.

The high degree of participation in activities sponsored by other organizations has increased the visibility of the +PLUS+ program in the mathematical community of the Los Angeles area. In the words of the on-site observer, "I'm beginning to see many of the same faces at a variety of math-related conferences, workshops, meetings and planning sessions. Members of the math community are getting to know one another and +PLUS+ teachers are represented everywhere." Many teachers have also noticed "familiar faces" at mathematics conferences.

E. Project Activities

The Los Angeles Urban Mathematics/Science Collaborative's +PLUS+ project sponsors three distinct kinds of activities: events for teachers from the forty-seven targeted schools in the eleven school districts (General Activities); activities for the three +PLUS+ teams (Activities for +PLUS+ Departments); and activities designed by each team as part of its Action Plan (Team Activities). These are described in Subsections of the Section "Collaborative Sponsored Activities."

During the 1986-87 school year, the collaborative supported the attendance of +PLUS+ teachers at several conferences, both within California and out-of-state. These are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

General Activities

+PLUS+ Workshop Series

A major effort of +PLUS+ Phase II during the 1986-87 school year involved a four-part series of Saturday morning content workshops at Wilson High School. Teachers from forty-seven high schools in eleven school districts were invited to attend the workshops, scheduled November 8, December 13, January 10, and February 21. The workshops were planned by a task force comprised of +PLUS+ teachers and associates from higher education and industry, as well as other members of the Los Angeles Urban Mathematics/Science Collaborative. The workshops, which focused on topics identified by the Workshop Steering Committee of the LAUM/SC, were titled: FUNdamentally Math, New Directions in Mathematics, Effective Software for the Math Classroom, and Scientific Uses of Mathematics Modeling/Advanced Math. A session on each of the four topics was offered on each of four Saturdays.

The thirty-three workshop instructors represented a variety of groups: six instructors represented corporations, six represented universities and colleges, five represented the county or district administration, and sixteen were teachers from ten schools. All the workshops were highly interactive and applied a hands-on approach, incorporating manipulatives, models, and simulations. Similarly, all four workshops stressed problem solving, estimation, and mental arithmetic, and the use of calculators in exploring real-life applications of mathematics.

Each workshop topic was addressed in four half-day sessions, for a total of sixteen hours over a four-month period. Teachers earned one salary-point credit from the Los Angeles Unified School District or professional expert pay of $150, one half paid by the LAUM/SC and one half contributed by their school district.

During the weeks between workshops, participants practiced and applied the new ideas and methods in their own classrooms and reported their results at the following sessions. This strategy provided the opportunity to field-test new ideas in a variety of settings, receive suggestions from colleagues, request new information and feedback from experts, and feel a sense of ownership in the process. This strategy also recognizes the developmental nature of learning, sets in motion the integration of new information into the mathematics program, and most importantly, recognizes the central role of the classroom teacher as the agent for change.

The end product of the workshop series was the Teacher Resource Book, developed by participants at each workshop for their own use and for possible dissemination to all participants. These books contain ideas, field-tested lessons, worksheets, lists of material resources, bibliographies, and lists of guest speakers. Rather than disseminating all the Teacher Resource Books, a decision was made to take one "best idea" from each Resource Book and assemble them in a single book which will be distributed during the 1987-88 school year.

Planning Meetings. The workshop's Steering Committee felt very good about the planning meetings and the overall value of the workshop series. After the committee's first meeting, an industry associate said, "This is an exciting project and it is interesting to see how schools operate differently from Hughes. I'm glad I could participate." After a later meeting, one teacher said, "I'm glad I'm a part of it. This is going to be a great series of workshops." An industry associate commented, "This is opening up positive dialogue between classroom teachers and administrators. It's transferring what teachers need to the power structure of teaching."

In late August, 1986, the workshop Steering Committee met to help two of the subcommittees finalize their fall workshops. After this meeting, one teacher commented, "We are almost finished, and it is worth every minute." Others said: "Glad to see some industry people working with us. They have good advice"; "The team work is good to be a part of. The strength is in working together."

On September 5, 1986, a luncheon meeting was held to coordinate the fall workshops, to report on progress, and to plan for the presenter's orientation scheduled October 2. After the meeting, one teacher commented, "Every time I come to one of these I feel energized. There is a group of outstanding people assembled." The on-site observer said, "Everyone was excited to be involved, and there was mutual respect by all who attended."

Initial Reception and Address. Wells Fargo Bank hosted a November 5 kick-off reception at the Crocker Conference Center for all participants in the +PLUS+ workshop series. Dr. Henry Pollak, who had recently retired from Bell Telephone Laboratories, spoke on "The Shortest Connecting Networks." Of the seventy-five people who made reservations, thirty-five actually attended, including thirteen teachers from the original three +PLUS+ departments. Teachers' comments were mixed; they enjoyed socializing with one another, but some felt the speech topic could have been better chosen. Asked whether the activity was worthwhile, teachers responded: "Yes. The people here are friendly, and I learned something"; and "Yes. Sharing information is so necessary." The on-site observer felt that the activity was well organized and that, in general, participants found it worthwhile. Teachers especially appreciated the opportunity to interact with their peers.

Lee Dembart, the Los Angeles Times science editor and a friend of Dr. Pollak, was present at the reception and was invited to attend a workshop series. After attending Bill Lucas' workshop on November 8, Mr. Dembart wrote an editorial that appeared November 13 in which he described the workshop and promoted discrete mathematics as the mathematics of the computer. The editorial noted that the twelve high school teachers who participated in the workshop spent time developing ways to adapt the problems presented in the workshop into curriculum enhancements for their classes. Dembart concluded: "The effort to bring this to school children and to show them that theoretical mathematics is a living, breathing, developing science is a commendable undertaking that promises large rewards."

November 8 Workshop. The November 8 workshop offered sessions on cooperative learning, profit analysis, operations research, computer careers, and developing intuition in science. The forty teachers who attended rated the event positively, with each of the sessions receiving an overall average rating of 4.5 on a 5-point scale. Words frequently used to describe the workshops included "informative," "exciting," "interesting," and "stimulating." When asked what they liked most about the workshop, participants responded: "I now have a way to use my more capable students' abilities without starting a separate class"; "problems related to industry"; "showed some problems which are hard to solve yet easy to understand"; "hands-on software examination"; "some entertaining problem situations for visualization, thinking, and solidifying"; and "coordinators were very willing to tailor workshop to suit participants' needs." Most teachers noted that they will try to adapt workshop ideas for classroom use.

One teacher commented, "You can teach an old dog new tricks. I never realized the retail business used this amount of math. Great exercise." One of the business associates noted, "I enjoyed being with the math teachers, and I'm available for field trips and to speak to math classes."

To encourage attendance at future workshops, collaborative coordinator Toby Bornstein announced that any teacher who brought a colleague to the December 13 session would receive $40 to purchase extra materials for his or her school, and the new teacher would receive a pro-rated stipend of $110 for attending the three remaining sessions.

December 13 Workshop. The December 13 workshop offered sessions on problem solving, experiments and game theory in the theory of fair division, the Geometric Supposer, and statistics. Fifty-five teachers attended, including fifteen who had not attended the first workshop. Overall, teachers rated the workshop 4.5 on the 5-point scale, and their comments were very positive: "These are the best workshops"; "The Geometric Supposer is fantastic. Can't wait to use it"; "This is exciting. We are learning about statistics"; and "These are by far the best (workshops). Great atmosphere and everyone is friendly. Small size gives all a chance to participate." The on-site observer added that the quality of the speakers and the size of the groups contributed to the event's success. Alan Amundsen, one of the speakers, was very encouraged by the number of participants who had preregistered for the software workshop and suggested that the proximity of a holiday may have been responsible for the relatively low turnout in November. Amundsen also suggested that workshop participants may have spread the word about the events' value, prompting additional teachers to attend. Participants' evaluation forms indicated that many would use workshop ideas in their classrooms.

January 10 Workshop. The January 10 workshop offered sessions on the use of the abacus and calculator, game theory, software used in teaching statistics and functions, and the use of vectors in the design of trusses and bridges. As with the previous workshops, the sessions focused on using mathematics effectively in the classroom and making it exciting, meaningful, and useful for students. Forty-seven teachers, all of whom had attended at least one of the two previous workshops, were present. Overall, teachers gave the workshop session a rating of 4.4 on a 5-point scale. One teacher expressed a hope that +PLUS+ would "offer these workshops again." Another said that it was "fun to 'stretch' in math again. . .it's been awhile." A third teacher appreciated the "collegiality of my individual group and [the] challenge of the problems." Presenter Barbara Wills of Huntington Park High School, LAUSD, said, "The teachers were great: motivated and open to new ideas. It was a pleasure being here."

February 21 Workshop. The February 21 workshop offered sessions on the use of computer data bases and graphics software, applications of logarithmic and exponential functions to real-world problems, and Euler's classical formula relating the faces, edges, and vertices of polyhedra. The forty teachers who attended gave the workshop an overall rating of 4.5 on a 5-point scale. One teacher called the workshop "exciting, enlightening, interesting." Another said that "[the workshop] provided several types of applications that are based on exponential theory, yet are very relevant to high school students." Another liked "the discussion during the last part of the session as to what's happening in math today and what shall/should we do tomorrow. [It was] better than all the other sessions."

A few of the presenters, primarily those from the Los Angeles Teacher Education and Computer Center (TECC), expressed the view that +PLUS+ should not duplicate the efforts of other organizations already sponsoring workshops for teachers. By the time the +PLUS+ series ended, however, these presenters seemed ready to acknowledge its value. Workshop participants also found the sessions very helpful. According to the on-site observer, one of the workshop's most positive contributions to teachers' professional well being was its role in bringing together representatives of a wide variety of sectors, including the city and county school district administrations, city and county schools, TECC, industry, and higher education, to accomplish a task. The process has fostered meaningful communication and increased interaction and listening among participants.

In responding to a questionnaire asking for an overall evaluation of the workshop series, teachers made several positive comments regarding the value of participation. One teacher said, "I learned that there are a lot of people in industry and higher education who are as concerned about the quality of secondary education as are the secondary teachers." Another said, "Interaction with other teachers, and in particular industry representatives, has given me a different perspective in my individual teaching situation." A third stated, "I've learned about some trends in applications and theory that could affect the future content of math curriculum in secondary schools." Nearly all teachers indicated interest in continued communication with other participants and presenters.

Workshop Assessment Meeting. On April 29, 1987, twelve teacher coordinators, presenters, district personnel, and math teachers met to assess the completed workshop series and to discuss changes to be made when planning future workshops. Among other recommendations, it was suggested that sixteen hours of EQUALS workshops be offered as part of the next workshops series, as well as sessions on probability and statistics, the Geometric Supposer, and the use of calculators and problem solving across subject areas for basic math students. Several suggestions addressed administrative concerns in an effort to streamline the workshops, to provide more flexibility, and to ensure their continued success. A LAUSD math resource person, for example, commented, "We are using too many people to coordinate these workshops. Next time let's not use 40 people to plan a workshop for 45." A teacher said, "I like what was said about bringing in industry. They certainly have helped us in the past. We need their continued support." A representative from the Los Angeles Council of Teachers of Mathematics noted, "These workshops are good and you should do them again. You've been able to accomplish what LAUSD can't and that's getting teachers out on a Saturday morning."

Activities for +PLUS+ Departments

Phase I End-of-Year Dinner and Resource Exchange

On June 3, 1986, +PLUS+ participants met for dinner at the South Pasadena School District Office Building to share what each of the three +PLUS+ schools had learned and accomplished during the 1985-86 school year as a result of their collaborative involvement. Nine teachers from Mountain View, five teachers from Wilson, Janet Freeman from Hughes, two UCLA associates, Dr. Newman, and the director and coordinator of the collaborative project attended. Ms. Bornstein had asked the teachers to submit "one great lesson" they had developed; each teacher received copies of all the lessons that had been submitted.

Before dinner, a representative from each team discussed its progress during the year. A discussion of professionalism and a brief update of plans for Phase II of the collaborative followed the dinner.

Participants noted that the facilitator's role had evolved into that of a director who assumed responsibility for team activities. This had occurred after it was determined that teams had not taken the initiative to plan their dinner meetings, and facilitators were asked to become more involved in organizing and coordinating these events. At Manual Arts, where the facilitator had resigned, Toby Bornstein had assumed these responsibilities.

The teachers appeared to be very positive about their teams' progress during the year; that sense of accomplishment had increased tremendously by June. One teacher said, "It is hard to believe how much we have accomplished. It was good to reflect and see what we have accomplished. We needed to do this so we could move on." The on-site observer commented: "This was a necessary meeting for all members of +PLUS+. It was rewarding to see them discuss what +PLUS+ has done for them. The sharing that took place and the new networks that they have set up made this year much better for them. Perhaps, most importantly, they felt more professional and good about themselves and their fellow +PLUS+ teachers."

Hughes Aircraft Brainstorming Session

On December 15, 1986, two or three teachers from each of the three +PLUS+ schools were invited to attend a brainstorming session to identify ways in which industry could interact meaningfully with teachers. The meeting was held at Hughes from 4 to 6 p.m. and included a buffet dinner. Fourteen people attended, including three teachers from Mountain View, three Hughes employees, five Hughes retirees, Peggy Funkhauser, Toby Bornstein, and Richard Curci. Participants found the meeting was worthwhile, and the representatives from Hughes appeared to be very interested in education and in helping teachers and students. One Hughes representative said, "I'd like to impress upon girls that math is an option. I'd like to try to have an effect on somebody." The on-site observer noted that the meeting was stimulating and productive, and that the groundwork was established to encourage teachers and industry people to work together in the classroom. "Everybody in the room felt that something special was happening."

Session on Promoting Effective Interaction

On January 15, 1987, members of the Los Angeles Urban Mathematics/Science Collaborative met at the Northrop Corporate offices to discuss ways to promote effective interaction between teachers and industry associates. Five teachers, thirteen industry associates, and ten representatives from LAEP, LAUSD, and the higher education community attended. An overview of the four Los Angeles Educational Partnership programs was presented. Janet Freeman, +PLUS+ associate from Hughes Aircraft, then presented the results of her efforts to create links between +PLUS+ teachers and Hughes retirees. Finally, Kaye Storm, IISME Program Director from San Francisco, presented the IISME model of industry internships which has been adopted by LAUM/SC. Questionnaires were distributed to industry associates to determine their interest in LAEP programs. Those present generally agreed that IISME offered great opportunities for teachers. The teachers who attended were enthusiastic about the program.

Breakfast Meeting

In conjunction with Barbara Nelson's visit to the Los Angeles Urban Mathematics/Science Collaborative, the project sponsored a breakfast meeting on February 12, 1987, at the Los Angeles Chamber of Commerce. Fifteen industry and university representatives, district employees, and high school teachers were present to hear Ms. Nelson speak on the Ford Foundation's Urban Mathematics Collaboratives program and the activities of the collaboratives nationwide. Those in attendance found the presentation and discussion very stimulating. One teacher commented, "I found what

Barbara had to say very informative. I'm glad I was invited." Another stated, "To hear what's going on nationally is a help. You know you are not alone. I had a pleasant time." A third said, "Gave us enough empowerment so we can push the right buttons to make things happen." A Community Service representative from General Telephone said, "I found what Barbara had to say interesting. It made me glad that I could be involved with +PLUS+ and hopefully be of some help."

Geometric Supposer Demonstration

On April 8, 1987, Richard Houde of Weston High School, Weston, Massachusetts presented a demonstration of the Geometric Supposer. Sixteen teachers attended the demonstration, which was held at Wilson High School. In the first part of the program, Mr. Houde taught a lesson using the Geometric Supposer to a group of students while the teachers observed. During the second hour, Mr. Houde directed the teachers in activities using the Geometric Supposer. The Los Angeles Unified School District provided substitutes for teachers who wished to attend. The teachers were impressed, both with Richard Houde and with the software program. One teacher commented, "Mr. Houde's skill with the software was matched by his ability to quickly assess where the students were. Observers were amazed at how many topics he was able to cover in a short period of time." Another teacher noted that using the Geometric Supposer did not mean less work for the teacher, but required a different kind of relationship between the teacher and students.

Teacher Associate Pairs Program

The Teacher Associate Pairs (TAP) program, or "telephone buddy" database, was established to facilitate meaningful interaction between high school mathematics teachers and mathematics professionals in the world of work. Teachers participating in the program were matched with outside resources in three major areas: mathematics, application areas, and form of interaction. Associates were first interviewed and then matched with teachers in the database.

The first TAP activity, scheduled in June, 1987, featured four Hughes associates who presented topics from Geometry, Algebra II, Consumer Math, and Computer Programming to Mountain View High School students and teachers. The presentations focused on calculating escape and orbital velocities for spacecraft, fuel costs for spacecraft payloads, the costs of making a surfboard, and careers and training in computer programming.

Team Activities

Wilson High School

During the 1986-87 school year, the +PLUS+ teachers at Wilson met during lunch every Thursday to share ideas and to plan. On occasion, speakers with an interest in mathematics were invited to attend, but generally the +PLUS+ teachers met alone. The meetings also offered opportunities to evaluate software and to arrange field trips.

Training they had received at Exeter in June, 1986, prompted mathematics teachers to push for access to the computer lab at Wilson High School so that new software, such as the Geometric Supposer, could be used by geometry students. With the principal's support, one of the two computer rooms was made available for that purpose. Four teachers were scheduled to teach in the room. In the fall, four of the eight geometry classes used the Geometric Supposer under the direction of Alan Amundsen, who went to Boston in November to be trained to use the software.

In November, 1986, the Wilson +PLUS+ team received a $1,000 grant from General Telephone of California to be used to purchase a repair contract for the school's Hewlett Packard computers. The grant resulted from the +PLUS+ group's connection with a GTE associate and was pursued by one of the teachers. Team members were delighted with this success.

Mountain View

The Mountain View +PLUS+ team named its program LINKS; through the team grant, team members planned to explore ways in which they can "link" students and their learning experiences to the realities of the society in which we live. To increase student awareness of the need for and the uses of mathematics in the business world, summer internships were organized; one student worked for TRW, a diversified corporation involved in space and defense programs, during the summer of 1986. Speakers were brought in through the career center on campus, and staff-development experts were identified to provide in-service on cooperative learning and software. As an outcome of the interchange with the staff development consultants, four Mountain View classrooms now have computers and printers.

The mathematics department at Mountain View, which was selected to participate in the Classroom Teacher Instructional Improvement Program (CTIIP), was awarded a grant of $3,000 to develop problem-solving strategies at all levels of mathematics. The department worked to revise its curriculum to conform with new state mathematics framework topics at all levels. Part of this revision involved acquiring materials and software to enrich the mathematics lab.

Manual Arts

Activities at Manual Arts have been directed toward providing for the basic needs of the mathematics teachers. By the end of the first funding period, the department had decided not to apply for continuing funds in 1987-88. It is possible, however, that the department will apply for funds for the 1988-89 school year.

COLLABORATIVE SUPPORTED ACTIVITIES

Professional Conferences and Association Meetings

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy. In June, 1986, one teacher from each +PLUS+ team and the project coordinator of the +PLUS+ program attended a conference on computers in secondary school mathematics in Exeter, New Hampshire. The Technical Assistance Project sponsored two of the teachers, and LAUM/SC sponsored the third teacher and the coordinator. The conference focused on the impact and application of the computer in the curriculum. Other topics included discrete mathematics, new developments in mathematics, and issues in mathematics education. The conference allowed teachers hands-on experience with computer software.

During the conference, the teachers attended two evening sessions on the Geometric Supposer presented by Richard Houde. Teachers from collaborative projects around the country participated in the workshop, which was organized by EDC. In addition, EDC sponsored a social gathering to provide an opportunity for teachers from all of the collaborative sites to become acquainted.

All three teachers and the +PLUS+ coordinator found the conference to be extremely beneficial. One teacher said, "The best conference I ever attended. I had a chance to work with many different softwares." Another said, "This was a well-organized conference with many things to learn and do. I enjoyed every minute, especially meeting other teachers." The teachers presented what they learned at the California Mathematics Council-Southern Section on November 21, 1986.

In summer, 1987, the LAUM/SC provided financial support for seven +PLUS+ teachers, one from each +PLUS+ department, to attend the Exeter Computer Conference. The costs of transportation, room and board were provided by the collaborative, in conjunction with the UMC Technical Assistance Project.

High School Math Project. During the summer of 1986, the collaborative funded four teachers from Manual Arts High School to attend the High School Math Project at UCLA and California State University-Los Angeles. The conference, which ran from June 30-August 1, provided high school mathematics teachers the opportunity to interact with their peers, to learn new approaches to teaching mathematics, and to prepare a mathematics workshop. The conference appeared to be an excellent growth experience for all four teachers. One teacher said, "I enjoyed learning some new things. Having to present a workshop was most beneficial. All teachers should experience this." Another said, "I feel this was outstanding. It was highly organized. The math portion and mentor teachers were good."

National Conference on The Influences of Testing On Mathematics Education. On June 27 and 28, 1986, the collaborative sponsored a teacher from Manual Arts High School and the on-site observer to participate in a two-day conference on testing in mathematics education at UCLA. The conference was sponsored jointly by the Mathematical Sciences Education Board of the National Research Council and The Center for Academic Interinstitutional Programs of UCLA. The event's primary purpose was to gather input from experts regarding the design of a major national study of the impact of testing in mathematics education. While the teacher who attended reported the discussion to be "a bit over my head," he did find it interesting.

California Mathematics Council, Southern Section Conference. On November 21 and 22, the California Mathematics Council held its annual conference for southern California in Long Beach. Four +PLUS+ representatives participated in a session about the collaborative. Toby Bornstein, the collaborative coordinator, presented an overview of the +PLUS+ program, including a review of which school districts were eligible to join. Jim Wigton, of Mountain View, described the program in greater depth and discussed its benefits. Evelyn Torres-Rangel, of Wilson, discussed the Exeter conference, the Geometric Supposer, and the ways she used the software in her classroom. Pam Grey, of Manual Arts, added details to the discussion of the Exeter conference and offered information about some of the other conference sessions. About fifty people attended at least part of the session, including Dr. Norman Webb from the UMC Documentation Project. The three teacher participants felt good about their presentations; it was the first time any of the three had presented to a large group. Several other +PLUS+ teachers also made presentations. Lorrie Freeman of Manual Arts talked about bilingual education, and Tom Walters of Wilson talked about a trigonometry identity useful in solving cubic equations.

LACTMA Conference. The 10th Annual Los Angeles City Teachers Mathematics Association Conference was held February 27-28, 1987, at Loyola Marymount College. Approximately 260 California teachers attended, with more than twenty +PLUS+ teachers or associates playing active roles as presenters, presiders, or officers. The conference was well received by the +PLUS+ teachers who attended. One teacher commented, "I learned something about probability I could use in my class." Another said, "I picked up some good tips for my classes." The collaborative encouraged participation, although it did not offer financial support. Teachers from Mountain View, who had never attended LACTMA, were invited this year because of their involvement in +PLUS+.

NCTM Annual Convention. The Los Angeles Mathematics/Science Collaborative funded twelve teachers to attend the annual meeting of the National Council of Teachers of Mathematics in Anaheim, California, on April 8-11, 1987. Five teachers were selected by lottery from those attending the 1986-87 Workshop Series, and one teacher was selected from each of the 1987-88 +PLUS+ mathematics departments. The Los Angeles Unified School District provided substitutes for six additional teachers who wished to attend the convention. Participating teachers were enthusiastic about the convention and enjoyed both the workshops and the opportunity to socialize with their colleagues. One commented, "I can use what I've been seeing in my class, and eating with other teachers has provided some great conversation. Last night we were talking about schools of the future." Another said, "I'm glad I won the chance to come down because I am excited about what I've seen. The session I attended on computer software was helpful and interesting." The on-site observer noted that one teacher who attended "has had a positive change in attitude toward teaching. He is trying new things for the first time in a long time."

Secondary Mathematics and Science Technology Institute (MSTI). Forty Los Angeles County math and science teachers attended a four-week residential program July 6-31, 1987, at the Lawrence Hall of Science. Several +PLUS+ schools submitted applications and three (Mountain View, Venice, and Huntington Park) were selected. Richard Curci, project documentor, was an instructor at the institute. Enthusiasm generated by the residential program is expected to produce a +PLUS+ workshop under the direction of Janet Miller, Huntington Park High School.

Summer Internships

A summer internship program was piloted during the summer of 1986. Originally, the collaborative arranged for industries to make seven positions in local industries available to teacher interns for a six- to eight-week period. Each teacher was to receive a weekly salary of $400 to $600. The program was designed to pair each teacher with an industry associate, who would serve as a resource person in regard to both corporate work and classroom application. As part of the program, the Teacher Interns would be required to develop a unit project or a set of supplementary materials to augment the existing curriculum. Furthermore, the interns were to participate in regularly scheduled weekly meetings with the industry associate to discuss applications of the summer work experience to classroom teaching. Participating teachers also were to attend weekly half-day field seminars with other +PLUS+ teachers.

In reality, only one of the seven internship positions was filled, as most teachers had already made summer commitments by the time the program was announced. Also, the application form included a survey of computer experience that many teachers found intimidating. Some teachers believed the program would not actually materialize; others did not believe they had anything to offer industry. The coordinator felt there was too little time to develop the program, given the multitude of other accomplishments during the project's first year.

In conjunction with other Urban Mathematics/Science Collaborative programs, six teachers were identified to work in industry during the summer of 1987. Four of the six teachers who would be participating are from +PLUS+ schools. It is interesting to note that teacher applications increased ten-fold over the previous summer, while the number of positions offered by industry remained constant.

F. Observations

The Los Angeles Urban Mathematics/Science Collaborative made considerable progress during the 1986-87 school year. Discussion of the collaborative's growth during the year is organized into four sections: Project Management, Collaboration, Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The establishment and development of the Los Angeles Urban Mathematics/Science Collaborative has been based on two fundamental strategies. The first involves focusing initial efforts on the mathematics departments of three target schools, and increasing the number of target schools each year. This approach has been necessary because of the sheer size of the area being served by the collaborative in terms of distance, number of districts, number of teachers, and number of students. The collaborative's second strategy involves encouraging collaboration by forming teams comprised of teachers, university associates, and industry associates. The teams serve as a central force in fostering greater leadership among teachers, in increasing effectiveness, in developing networks among the various groups, and in improving the mathematics curriculum.

The collaborative is managed to a great degree by coordinator Toby Bornstein, with advice from the Advisory Committee, and with the help of activity-specific steering committees. The steering committees, such as those used to plan the +PLUS+ Workshop Series, have proven very useful in dividing responsibilities among a number of people, including teachers, and university and industry associates, thereby decentralizing leadership.

As a result of this structure, some teachers are beginning to take more initiative, as demonstrated in the planning of the Geometric Supposer presentation on April 8. That Ms. Bornstein felt her attendance at the session was unnecessary supports the observation that teacher autonomy is increasing.

As the project continues to move from its initial developmental phase, the organizational structure must adjust as necessary. Greater complexity and numbers will demand a wider distribution of responsibilities. The growth of a cadre of teachers experienced in the +PLUS+ project and the development of the Teachers' Advisory Council will facilitate some redistribution of work and foster greater teacher ownership in the overall program. The need will persist, however, for coordination and administrative support. It will be of interest beyond the particularities of the Los Angeles collaborative to document how these developmental issues will be addressed over the next several years. Not only will the projected development of +PLUS+ involve an increasing number of schools, but the total will increase by greater increments each year. There were three schools involved in the pilot period of 1986-87; the number increased to seven in 1987-88, and will expand to fifteen in 1988-89. The number of participating districts will remain constant.

Ms. Bornstein has assumed responsibility for communication within the collaborative. In addition to updating the advisory committees on collaborative activities and preparing activity reports, she visits the three target schools to talk with teachers during their breaks and lunch times in order to maintain personal contact with them and to keep them informed. The manner in which communication links are established and maintained as the number of participating schools increases will provide one indication of the viability of collaborative growth. It appears that expansion will demand increased delegation of responsibility to the teachers. This does, in fact, seem to be occurring. In planning the +PLUS+ workshops, teachers assumed responsibility for communicating with one another. Electronic mail also will be used to maintain communication among the various +PLUS+ sites.

Spreading the word about the collaborative to the larger community, comprised of the forty-seven schools, has presented a more difficult problem; such simple but essential processes as ensuring that collaborative information is directed to the correct person in each district has been a challenge. During the first year of the project, the coordinator depended on the mathematics supervisor in each district to identify those who should receive collaborative information, but this was not very productive and resulted in low attendance at collaborative events open to all districts. During 1986-87, the collaborative coordinator identified the key person to receive information in each district, and the number of districts represented at general events increased. Teachers at the various schools learned about the workshops through their department heads and through fliers sent by the collaborative. Workshop attendance also increased as teachers spread the word about the quality of the sessions. Increased interest in the collaborative suggests that information is being disseminated and the change in collaborative procedures indicates that lessons are being learned.

The collaborative has made inroads into the districts. Mr. Les Winters, the mathematics supervisor of LAUSD, has attended several activities. Local school districts also have agreed to pay half of the honoraria for teachers who attended the +PLUS+ workshops. Barbara Nelson of the Ford Foundation met with LAUSD'S superintendent as a result of the efforts of Peggy Funkhouser, the Executive Director of the collaborative.

School involvement extends beyond the induction and funding year. All +PLUS+ schools retain representation on the Teacher Council indefinitely. As the project expands, a more complex structure will be needed. Already Erwin Tomash, co-chair with Hal Slavkin of UMSC, is considering this problem from a corporate manager's point of view.

COLLABORATION

One collaborative objective is to promote a feeling of camaraderie among the mathematics teachers within each +PLUS+ school. The three target schools varied greatly in terms of how the teachers had related to one another prior to joining the +PLUS+ project. Manual Arts mathematics teachers were isolated in separate buildings and interacted only rarely. Wilson mathematics teachers met as a department occasionally and would see one another throughout the school day. Mountain View mathematics teachers met regularly at school and socially at a dinner gathering once each month. After a year of collaborative participation, each school has experienced some changes that appear to have resulted from collaborative activities. At Manual Arts, an empty room has been converted to an office for mathematics teachers. This space enables mathematics teachers to congregate over lunch or while preparing materials, and it appears that the teachers have initiated some level of group communication. While some teachers have assumed individual or small-group projects, such as establishing a tutoring program involving college students and painting an office for mathematics teachers, there remains a sense that group communication could be improved. At Manual Arts guest speakers have been invited to the school and steps were taken to make contacts with an industry logistics expert.

At Wilson and Mountain View, mathematics teachers communicate on a regular basis. At Wilson, the six +PLUS+ teachers frequently eat lunch together, and have socialized outside of school by participating in a collaborative-initiated camping trip; this relationship is a direct result of their association with the collaborative. At Mountain View, the high level of interaction among the mathematics teachers has continued throughout their collaborative involvement. While the collaborative has facilitated communication within all three schools, the degree of team building varies by school. The evolution of communication among teachers at Manual Arts will be a true indication of the impact of the team approach.

Planning meetings for the +PLUS+ workshops and dinners have encouraged interaction among teachers from different schools. The effectiveness of these activities is evidenced by the participation of teachers from different schools in cooperative activities, such as joint presentations. In one instance, a teacher at Mountain View taught classes for a teacher at Wilson.

Within each site, team management and the collaborative direction have depended to some degree on the group's cohesiveness prior to collaborative involvement. The resolution of organizational issues appears to be as important as the consideration of instructional issues. Thus, dual focuses have emerged in the +PLUS+ program: the first is a concern for leadership development, and the second is an increased emphasis on the mathematical and pedagogical content of activities. Schools progress on these individual issues at independent rates. Organizational and pedagogical issues will continue to exist concurrently, and, in fact, may become more complex as schools join the collaborative and an increasing disparity emerges among schools in terms of their experience with the program.

The +PLUS+ Workshop Series provided an environment that fostered collaboration. Teachers, industry representatives, and college professors worked together to develop and to present the workshops. The Workshop Steering Committee and the groups planning each of the four workshops met several times. Teachers provided significant input to the speakers (other teachers, and representatives from industry and colleges) as to the approaches that would be most appropriate with teachers, the content that would be of interest, and how that content should be presented. These groups reviewed the presentations before they were given and offered suggestions. Workshop instructors from industry and colleges were encouraged to limit workshop content and to use language that would be meaningful to teachers. Teachers from Wilson assumed a great deal of the responsibility for workshop preparation, such as ensuring that presenters had access to the appropriate equipment, including overhead projectors, TV monitors and VCRs.

The workshops also were presented in a spirit of collaboration. A teacher generally introduced the speaker, reviewed the schedule for the day, and reminded other teachers that at some point in the day they were to write activities for the Teacher Resource Guide. Speakers were teachers, university professors, or representatives of industry, and several workshops included members of all three sectors, which offered participants an opportunity to alter their perspectives on the topic under discussion and to come to understand that they all had much in common. In some workshops, interaction among teachers, professors, and industrialists was encouraged further through small-group discussion. For example, all the participants had been confronted at some point with students or employees who would derive solutions to problems that failed to match the physical conditions or that were very unreasonable in other ways. These workshops fostered a high degree of collaboration in which one participant was not lecturing to another, but all were interacting at the same level and all--teachers, professors, and industrialists--were benefiting.

Another important form of collaboration has involved interaction among teachers, both in the context of +PLUS+ activities, and within +PLUS+ schools themselves. Prior to the existence of the collaborative, teachers had limited opportunities to interact. Many schools have not routinely held mathematics department meetings. Because of their association with the collaborative, Wilson teachers during 1986-87 met during a lunch period once each week. While the teachers at Mountain View met regularly prior to their involvement in +PLUS+, this is not a typical situation in all schools.

In addition, the +PLUS+ program has provided a strategy for institutionalizing networks among teachers, and between teachers and others. The participating departments are contributing significantly to a sense of community beyond their individual buildings and districts, forming the basis of a long term diffusion process, which has as its endpoint general institutionalization of the social relationships and professional linkages established.

The collaborative also has provided teachers with more direct access to school district administrators. Many teachers had never talked with Les Winters (LAUSD mathematics supervisor) until he attended several workshops. In addition, Peggy Funkhouser reported that, as a result of his meeting with Barbara Nelson of the Ford Foundation, Mr. Winters is considering using the collaborative as the structure through which to implement the state mathematics framework in the Los Angeles Unified School District.

TEACHER PROFESSIONALISM

The planning process for the +PLUS+ workshops offered an impetus for the development of teacher leadership. The workshops were prompted by the pilot teachers' need to develop classroom applications for ideas they received through contact with other practicing mathematicians. Teachers helped set guidelines, select topics, and develop the model and evaluation instrument for the workshops. They helped identify presenters and served on the individual planning teams for each workshop. Many acted as teacher coordinators, ensuring that the workshop guidelines were followed. In addition, they oversaw the sharing of field-tested ideas by workshop participants for inclusion in each Teacher Resource Book.

Teacher initiative and leadership at each of the schools also are emerging, with a particular focus on mathematics and teaching. As the original three +PLUS+ departments come to grips with their own leadership problems, the lessons they have learned are being applied in subsequent leadership workshops for the Phase II schools. Experience, for example, has emphasized the necessity of departmental cohesion, resulting in a revised approach to the development of collaborative techniques and team building based on that cohesion.

At Manual Arts, teachers organized some activities and created their own office space. While these successes were accomplished by two individuals, their efforts were directed at improving the work situation of all of the teachers. In addition to establishing their own office space, two teachers at Manual Arts have expressed interest in the position of department head, resulting in the need for an election.

At Wilson, six of twelve mathematics teachers are +PLUS+ members. Initial reports from Wilson indicated that, while the teachers were meeting, no one had assumed leadership. As the school year progressed, and with the beginning of the 1986-87 school year, however, individual teachers began to take the initiative. The group went on a camping trip. A teacher visited Boston to learn to use the Geometric Supposer and then presented a workshop; this teacher also convinced the school to use the software in four of eight geometry classes, which required solving scheduling problems and garnering support from the principal. Another teacher was instrumental in establishing a computer room. All of these activities point to emerging leadership.

At Mountain View, the sense of department cohesion was strong even before its collaborative involvement. Program participation has fostered the association of Mountain View teachers with teachers in other schools. Also, the team has sponsored several activities and, as at Wilson, more individuals have assumed such responsibilities as making presentations at conferences, and planning and conducting workshops.

This development is taking place in an environment in which teachers often feel that they are not treated as professionals. They have no opportunity to attend professional meetings; a teacher who wants to attend a meeting must arrange with other teachers to cover his/her classes. Some teachers thought they would be unable to attend the NCTM meeting in Anaheim because of the difficulty in gaining release time. Teachers share a perception that innovative work is unrecognized and unrewarded. Mathematics teachers are not provided office space; the rooms in some schools designated as mathematics department offices were built as small storage areas. This limiting environment is amplified by the presence of those teachers who are ambivalent about activities that may foster professional growth. Some teachers view their work hours as 8 a.m. to 3 p.m., Monday through Friday. In the target schools, many teachers who hold these views have chosen not to participate in the +PLUS+ program.

The three pilot sites have provided an interesting contrast and a good test for the collaborative. While progress is evident at all sites, the degree of each department's involvement varied substantially. Two schools will continue their involvement in 1987-88, and the third may reapply to participate in 1988-89. The level of a department's participation in the +PLUS+ program was influenced somewhat by the level of teacher involvement and the working relationships among staff prior to +PLUS+. The issue now is whether--and how well--the lessons learned at the three schools are being applied to the other five sites as the collaborative expands.

One factor that has emerged as essential to significant participation by an active group of teachers is the involvement of the department head. In the pilot sites, this involvement varied greatly. At Mountain View, the department head has been very active in the +PLUS+ program and has attended activities with other department teachers. At Wilson, the department head has not been integrally involved in the collaborative, but has been supportive of the activities the project has initiated. On the other hand, a leadership problem appears to exist at Manual Arts. Two teachers at the school have been active in the collaborative, but their participation has not been accompanied by a concerted departmental commitment. The department has not followed through as a group on its proposed activity; it appears that one reason contributing to this lack of enthusiasm is the decreased level of involvement or interest the department head has exhibited.

Mathematics department heads have the power to influence change. They are elected by the teachers, they are assigned a free period each day for departmental business, they receive an additional $500 per semester, they assign teachers to classes with the approval of the principal, and they designate the amount of curricular material classes are to cover by the end of the semester.

MATHEMATICS FOCUS

The collaborative's mathematics focus has emerged from the +PLUS+ Workshop Series and from individual teachers' interests. Unlike many collaboratives, the LAUM/SC is not centered on a general theme, such as an emphasis on problem solving. Instead, teachers from the target schools have identified areas of interest or need, suggested resources to help address the topics, or used team grant money to purchase needed materials such as calculators. Among the topics addressed at the Workshop Series were applications of mathematics in science and business; discrete mathematics, including operations research, fair division, game theory, and geometry; software for teaching mathematics; and computer applications.

A short session presented prior to the last of the four +PLUS+ workshops concentrated on computers in the classroom. The workshop's presenter suggested that computers can be used in three ways: (1) as an object of study (language skills, hardware, programming); (2) as a tool (word processing, data sheets, spread sheets, and applications software); and (3) as an aid for instruction. She explained how different levels of thinking are used with each tool and how these levels relate to problem solving.

The workshops in general exposed teachers to some contemporary mathematics, although the degree of their exposure varied among individual teachers. The workshops apparently have impacted on classroom teaching. In an early workshop, for example, Janet Freeman of Hughes talked about trusses; a teacher in attendance went back to her class to teach a session on trusses in which weights were extended from a thread until it broke. Then a truss was built with the same size thread. The students found that the truss would hold more weight. After the teacher explained this, Ms. Freeman noted that the equation did not support this finding, that is, if the same thread was used, the truss should in fact support less weight. This anecdote suggests that some teachers may not fully understand all of the principles underlying the lessons they are presenting to their students. Nonetheless, teachers are experiencing and thinking about ways that mathematics is used and ways that it is changing.

G. Next Steps

The Los Angeles Urban Mathematics/Science Collaborative will continue to foster teacher leadership and guidance and to concentrate on team building. The collaborative is to become a forum for addressing and meeting the needs of mathematics educators in Los Angeles County by bringing together organizations and institutions to promote the learning of mathematics and the pursuit of mathematics-related careers.

The number of departments in the +PLUS+ program increased from three to seven during the 1986-87 school year, and will increase to fifteen during 1987-88. Manual Arts High School has chosen not to apply for renewal of its grant as a participating +PLUS+ department. It may, however, exercise its option to reapply for a grant in 1988. The mathematics department is still maintaining some level of involvement in that it will continue to have a representative on the +PLUS+ Council.

Some collaborative programs, such as the workshops, will be offered to teachers in all forty-seven targeted schools. Efforts will be directed towards making teachers aware of collaborative-sponsored activities and increasing the number of teachers who participate in them.

As planned, the annual cycle of events will involve fall workshops for all teachers; applications by and selection of mathematics departments to become new +PLUS+ teams; submission of Action Plans by +PLUS+ teams; and realization of the activities outlined in the Action Plans, including spring collaborative workshops and summer internships. The fall 1987 workshops will be planned at a meeting in July; coordinators and presenters will then work independently over the summer to refine their workshop plans. Presenters and teacher coordinators will meet in October.

Collaborative efforts to provide modems and telephone lines to access the Teacher Education and Computer Center (TECC), Mathematics/Science, and the Space Program bulletin boards have been impeded by a withdrawal of state funds for equipment and services and the suspension of state funding for TECC and its electronic bulletin board. A small Common Ground network will be established in its place, and plans to collaborate with the California Museum of Science and Industry are being pursued. It is hoped that a communication link can be established that will encourage and facilitate networking among +PLUS+ teachers, and among these teachers and other mathematics resources in southern California.

Efforts will be made to encourage more +PLUS+ departments to join the TAP, (Teacher-Associate Pairs) program. A meeting will be scheduled at which representatives of each +PLUS+ department will learn more about TAP and will have an opportunity to volunteer to serve on a teacher committee charged with refining the model. TAP developments will be integrated into the planning of departments' use of external resources--a collaboration retreat in early 1988 and the 1988 Workshop Series.

The collaborative will continue to provide opportunities for +PLUS+ department teachers to attend local, state, and national seminars and mathematics conferences. During summer 1987, the LAUM/SC will also send four teachers to the North Carolina School of Science and Mathematics for the NSF-funded seminars on the fourth-year college preparatory curriculum. These teachers will conduct a workshop during the summer of 1988 for twenty local teachers.

SUMMARY REPORT:
MEMPHIS URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Memphis Urban Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term intent of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first months have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Memphis Urban League; documents and interview information provided by the project staff; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

MEMPHIS URBAN MATHEMATICS COLLABORATIVE

A. Purpose

As stated in the funding proposal submitted to the Ford Foundation, the primary goal of the Memphis Urban Mathematics Collaborative is to promote an environment of professionalism for mathematics teachers and to assist them in broadening their horizons; to establish creative working relationships between mathematics teachers and other professionals in colleges and universities, and in business and industry; and to develop creative projects that will result in teachers' improved abilities to relate mathematical concepts to students in a practical way.

B. Context

Memphis has a population of 646,356, with a racial mix that is 47 percent black and 53 percent white. School system enrollment totals 105,000, of which 72.3 percent of the students are black, and 27.7 percent are white. More than half (53.9 percent) of the families in the school district are classified as low income. Many of the students in the district live without one or both parents and work as much as 30 to 40 hours per week in addition to attending school. Many join the military on leaving school, a number continue to post-secondary education, and others find work in the area.

The Memphis school district was recently rated among the most segregated school systems in the South by a University of Chicago study. The average black student in the Memphis city schools attends a school in which only 18.4 percent of students are white. Many white families have left the inner city and moved into the county school district. In addition, many private school systems have emerged within the city. Desegregation of Memphis public schools was ordered by the courts in 1972.

The Memphis School System ranks twelfth in the nation in terms of size, and forty-eighth in the nation in terms of per-pupil expenditure. The district is comprised of twenty-seven high schools, twenty-six junior high schools and an "optional school" program (a magnet school within a school in twenty-two schools, eleven of which are high schools). One of the schools in the collaborative, White Station Junior High, has been named as one of the "Ten Great Schools" of Tennessee for 1987; the award carries a $10,000 grant.

Students must pass a proficiency test in order to earn a diploma; the test standard is at about the eighth grade level. Students are allowed to retake the test four times, and those who do not take the test or fail to pass it receive a certificate rather than a diploma. The school district is experiencing some public pressure about student performance on state tests. On both the Basic Skills Test (grades 3, 6 and 8) and the Stanford Achievement Test, district students scored below the state average.

The Inner City School Improvement Program (ICSIP) is housed in the new Martin Luther King Educational and Cultural Center, which was dedicated March 13. The program offers after-school tutoring, an after-school homework center, peer programs for drug abuse and teenage pregnancy, adult vocational courses and computer education. About 370 students enrolled this year in summer school, peer counseling, or neighborhood clean-up clubs. It is anticipated that adults will use the center to prepare for the GED, to take vocational courses and to discuss parenting skills.

The school system employs 345 mathematics teachers; 50 percent are black, and 50 percent are white. Of the 345 mathematics teachers, 321 are certified to teach mathematics; not all of the certified teachers are currently teaching mathematics. Consequently, it can be surmised that at least twenty-four of those teaching mathematics are not certified to do so. Seven of the certified teachers hold doctorate degrees, 59 have course credit beyond a master's degree, 107 hold master's degrees, and 148 hold bachelor's degrees. Marietta Harris is the K-12 Mathematics Consultant for the district. She and three mathematics supervisors are responsible for evaluating district mathematics teachers.

The district textbook committee is comprised of teachers appointed by the mathematics consultants and supervisor, usually on the recommendation of principals. As an incentive for participation, teachers are granted one unit of credit toward recertification for every sixteen hours of committee work. The Southern Association requires teachers to earn six units every five years to retain their certification.

The superintendent of the Memphis City Schools, W. W. Herenton, is nationally respected. Executive Educator magazine named Herenton as one of 100 outstanding school managers in 1980, 1984, and again this year. Under Herenton's direction, the district has established ten new goals for the 1987-88 school year, including "to strengthen collaborative relationships with colleges, universities and the private sector."

Political discussion continues about the possible consolidation of the city and county school districts. Several sensitive issues are involved. In the city schools, 77.5 percent of students are black, compared with 14.5 percent in the county schools. Furthermore, it is estimated that $109 million is needed to rectify the building problems of the two districts: county schools are severely overcrowded while the city schools are in great need of maintenance.

State legislative action continues to impact directly on the Memphis schools. The county property tax rate was not raised, although a four-cent tax was shifted from one line of the budget to fund school improvements, contributing about $1.75 million to the city and county schools this year. Curricular changes stemming from the Comprehensive Education Reform Act of 1984 include revised college admission standards that require algebra I and II and geometry, prerequisites for mathematics courses for degree program credit, and college remediation programs. These changes will affect both the content of high school courses and the district's retention rates. The selection of new texts, in effect until 1993, was influenced by both the Act and the recommendations of the College Board.

The Governor of Tennessee has established a career ladder for teachers consisting of three steps. Teachers can progress by taking tests and submitting to an evaluation of their classroom teaching. At the first level, teachers are required to have four years classroom experience and a passing score on the National Teachers Test. Level 1 teachers receive an extra $1,000 for a ten-month contract. Level 1 teachers with nine years of teaching experience can reach Level 2 by receiving acceptable evaluations from two state-designated evaluators, the principal, a district mathematics supervisor, and one class of students selected by the teacher. Level 2 teachers receive an extra $2,000 for the ten-month contract and are eligible to work an eleventh month to receive an additional $2,000. Level 2 teachers with thirteen years of teaching experience can reach Level 3 by successfully meeting additional evaluation requirements. Level 3 teachers are entitled to an extra $3,000 for ten months and can receive another $2,000 for an eleventh month (an additional 70 professional hours) or another $4,000 for twelve months work (140 additional professional hours).

During 1986-87, teachers at career ladder levels 2 and 3 were allowed some flexibility in accruing the extra hours required for the eleventh- or twelfth-month salary increment. Teachers could tutor students after school or on weekends during the regular school year, serve on the collaborative's advisory board, or develop and present a workshop to other teachers. However, time spent on self-improvement or professional growth activities, such as workshop attendance, could not be applied toward the required hours. Some teachers worked the extra 140 hours within the ten months of the school year, were paid for twelve months and still had two summer months free. Other teachers taught summer school to complete the 140 hours. The state contributes the needed funds to pay Level 2 and 3 teachers for extra months work. To retain their career ladder status, teachers at Levels 2 or 3 who do not hold a master's degree must take three hours of coursework every five years in an appropriate area other than education. At Level 3, credit hours toward an extended contract can be earned for out-of-school activities related to teaching and for conducting teacher-improvement activities.

Memphis is one of the fastest growing cities in the nation. It is, however, heavily dependent on the transportation and distribution industries. One of the major employers in this sector, Sears, announced that it is closing its Memphis distribution center in 1988, which will result in the loss of 1,100 local jobs. Four new business developments, however, promise more job openings in the Memphis area. A new Marriott hotel will hire 300 employees. Payless Cashways, a building materials business with 187 stores nationwide, plans to open three stores in Memphis. The first should be in operation in about one year, with the other two opening within two years. Great Western Financial Corporation's relocation of part of its operation from Miami to Memphis could result in 350 new jobs in the Memphis area. Since Memphis became a hub for Northwest Airlines, the traffic at the Memphis International Airport has increased tremendously, and Northwest has announced it soon will add 130 workers to its current Memphis payroll of 2,500. Most of these will be formerly laid-off Northwest workers or workers transferring to Memphis from other cities.

Memphis' recent selection as the site of a $56 million Navy testing center will have a major impact on area industry. Construction will begin in October, 1987, and the center should open in 1990. The center will test large-scale ship and submarine models. The testing center, which is expected to provide hundreds of new jobs, will also create job opportunities in local service businesses.

C. Establishment of the Collaborative

The Memphis Urban League is the funding agent for the Memphis Urban Mathematics Collaborative. In May, 1986, a planning grant of $2,500 was awarded to the Memphis Urban League to convene the four-month process of designing a collaborative and preparing a proposal. The planning group consisted of representatives of the Memphis Public Schools and of the Memphis Urban League, professors and administrators from local universities, and leaders from the business community. Teachers played a major role by offering ideas and suggestions for collaborative activities. The proposal was submitted September 4, 1986, and the grant was awarded October 9, 1986, making Memphis the eleventh and final site to be funded as part of the Ford Urban Mathematics Collaborative project.

The Memphis Urban Mathematics Collaborative is comprised of and receives support from the Memphis City Schools; five universities and community colleges; and, currently, sixteen corporations, businesses, and public agencies. The Memphis Urban League and the school system enjoy an unusually close relationship. The superintendent of the Memphis City Schools is a former member of the Memphis Urban League Board who currently serves as a member of the Board's Committee of Advisors. Nineteen of the thirty-eight members of the Board are designated representatives of Memphis businesses. These representatives have expressed support for the collaborative and enthusiasm for the League's role. The League's Board has assumed a firm position that the project should be well coordinated with the Memphis City Schools.

Nancy Gates, a Memphis mathematics teacher and recipient of a Presidential Award for Excellence in Mathematics Teaching, serves as the collaborative's project director. She reports to Herman Ewing, the Executive Director of the Urban League, concerning all administrative functions, and to the collaborative's Advisory Committee about program objectives and implementation of action plans. Ms. Gates also organizes and coordinates a committee of teachers who act as liaisons between the Advisory Committee and the mathematics teachers in the twenty targeted schools. This committee also advises the project director in the recruitment and selection of teachers who will benefit directly from collaborative participation. Ms. Rita Ross, a high school mathematics teacher who received the 1986 Rotary Award for Teacher Excellence, is the on-site observer.

The nineteen-member Advisory Committee is the collaborative's governing body. The committee is comprised of five mathematics professors from major colleges, one representative from the Human Services Division of a college, four from businesses, two from the school-system administration, two from the Urban League's Education Committee, and five teachers. Committee membership can be increased by majority vote of members present at a regular meeting. The Advisory Committee oversees the project and appoints subgroups to manage each collaborative activity.

The Advisory Committee, which first met in September, 1986, convened whenever necessary, which averaged once each month during the 1986-87 school year. The committee met more frequently in the spring as the proposal for refunding was prepared. On April 6, 1987, the Advisory Committee met at Rhodes College to review the collaborative's first year and to determine how to better accomplish its goals in the years to come. Topics for discussion included funding for the summer workshops; increased business representation on the Advisory Committee; the responsibilities of the director, coordinator, and other collaborative officers; and the proposal for refunding that was due June 1, 1987. Twelve committee members and Mark Driscoll, the director of the UMC Technical Assistance Project, attended.

The Advisory Committee met again April 27, 1987, at the Memphis Board of Education Building to continue work on plans for the refunding grant. Eleven members and Barbara Nelson from the Ford Foundation attended. Various issues were discussed, including funding of workshops, future activities, issues in mathematics education, and the development of links between teachers and mathematicians from the business/higher education communities.

On May 18, 1987, sixteen members of the Advisory Committee met at Rhodes College to discuss the rough draft of the proposal for refunding to be submitted to the Ford Foundation. The addition of an "outreach consultant" position to the governing structure of the collaborative was discussed; the consultant would work with the project director and answer to the Advisory Committee. Several key issues in mathematics education also were discussed, including the role of calculus in the high school curriculum, alternatives to calculus, minimum requirements for mathematics in the Memphis City Schools, and possible changes in current curriculum.

Twenty of the fifty-three high schools and junior highs in the district were designated as target schools during the collaborative's first year of operation. Those involved in initiating the collaborative identified the target schools so that there would be an equal number from each of the four areas of the district and a racial mix. In addition, a prerequisite for involvement was that the principal of a target school had to express willingness to cooperate with the collaborative project. Mathematics teachers from the twenty target schools, who have been given first priority in terms of participation in collaborative activities, were asked to propose ideas for collaborative events. These teachers, for example, were offered the opportunity to register for summer workshops before registration was opened to teachers from other schools in the district.

Teacher information-and-input meetings were held throughout December, 1986, at various Memphis City Schools. Sixty-nine teachers attended these meetings, at which collaborative representatives discussed the project's goals and prospects and solicited information from participants regarding their ideas about summer courses, and about the Resource Associate program. Teachers also were asked to provide the names of any leads or contacts in the business community they may have had that could help the collaborative. One teacher said, "A majority of teachers at my school are willing to participate in this collaborative." Another said, "I believe in incorporating the businesses into the school scene. I think there is a lot of merit and opportunities with the program. There is a need for this." A third said, "The ability to experience mathematics in the workplace is a plus, as well as the time allowed to work with industry."

As a result of the planning meetings, four subcommittees of the Advisory Committee were formed: the Speakers Bureau Subcommittee, the Resource Associate Subcommittee, the Summer Workshops Subcommittee, and the Internship Subcommittee. These four subcommittees have been instrumental in the planning and implementation of the major activities of the Memphis Urban Mathematics Collaborative.

In June, 1987, Barbara Nelson of the Ford Foundation met with representatives of the school district administration, the collaborative, and the Memphis Urban League to discuss the progress of the collaborative over the year and the proposal for refunding. Some differences in the understanding of the purposes for the collaborative were discussed. School district support for the project was affirmed in its explicit acknowledgement that all sectors must work together if the collaborative is to succeed. As a result of the meeting, it was agreed that representatives from the three groups would meet monthly in the assistant superintendent's office as a means of maintaining communication among all participants and ensuring adequate administrative support for the collaborative.

Another outcome of Ms. Nelson's visit to Memphis was a decision that a position be created to assume fundraising responsibilities for the collaborative. During the summer of 1987 an outreach consultant will be hired. In light of the collaborative's relationship with the Urban League, care must be taken that local companies are not subjected to funding solicitations from both organizations. During the 1986-87 school year, the required matching funds were obtained through in-kind service from the Urban League and a $6,000 donation from the Board of Education. During the 1987-88 school year, the collaborative plans to raise $19,000 in matching funds.

D. Relationship with Other Local Initiatives

The Memphis Urban Mathematics Collaborative is administrated by the Memphis Urban League. One of the 113 affiliates of the National Urban League, the Memphis League shares the national role of advocacy for the black and the poor. The Memphis League currently operates a computer-skills training program for adults, which leads to job placements in local businesses, and an education program for parents, which informs them of local educational issues and helps them to become active and informed consumers of public education. The League considers the mathematics collaborative an additional avenue through which it can work to improve the educational opportunities of the black population in Memphis by improving the professional status and mathematics knowledge of the district's high school mathematics teachers.

Both the superintendent of schools and the director of the League maintain strong ties with the business community. The mathematics collaborative is one of a series of local projects designed to be consistent with and supportive of the goals of Future Memphis, the Memphis Rotary Club, and the Adopt-A-School Program of the Memphis City Schools.

The collaborative is linked to the Memphis City Schools through the district's Division of Optional Schools/Ford Foundation Project. The director of this division is a member of the Advisory Committee and is responsible for reporting the collaborative's progress and needs to the Office of the School Superintendent. That the district listed "collaboration" as a priority for the 1987-88 school year suggests that its link with the MUMC should become stronger and more established in coming months.

Memphis City Schools are participating in a variety of new programs, including the Memphis Compact, a scholarship program funded by Chief Auto Parts, and a pilot program to test recommendations made by the country's governors. Memphis is one of seven cities to be funded by the National Alliance of Business for establishment of the Memphis Compact, a program aimed at providing a job or a college placement for every needy student who graduates from a public high school. The program also will address key issues concerning career incentives, parental control of school choice, and the school success of poor students. The Chief Auto Parts Scholarship program provides a total of $18,000 to be used to encourage disadvantaged students to remain in school. Each of eleven ninth-grade students will receive a trust fund payment of $550 annually, and an additional $1,650 upon graduation. Each student will be paired with a corporate mentor. While these activities are outside the collaborative's organization, it seems inevitable that they will affect many of the same populations of teachers and schools.

In January, 1987, the Memphis Public Education Fund was formally established. In its first initiative, the Fund solicited applications for Teachers' Initiative Grants, which could total up to $200 each and could be applied toward college tuition for mathematics courses as well as for creative or innovative instructional projects, projects using nontraditional techniques or community resources, and supplies and equipment for use in such projects. Six members of the MUMC Advisory Committee serve on the grant selection committee, ensuring a close bond between this new project and the collaborative. Of the 230 applications processed, 149 grants totaling $26,700 were awarded. Sixty schools, including several of the collaborative's targeted schools, were represented.

Middle College High School, located at Shelby State Community College, will open in fall, 1987, with a class of 100 students, of which 77 percent are black. The school will add 100 students each year for a total enrollment of 300 by 1989. The program is designed to retain students who typically would drop out before graduation. Small classes, an interdisciplinary curriculum, and an explicit, signed commitment from students to attend, to be on time, and to work at their studies are all elements of the program, which is based on the MCHS at LaGuardia Community College in New York. First Tennessee Bank donated $50,000 in seed money to the program.

E. Project Activities

A majority of the activities offered to mathematics teachers by the Memphis Urban Mathematics Collaborative were initiated as a direct result of planning meetings held with teachers in December, 1986. These activities, designed to promote professionalism among Memphis mathematics teachers and to establish linkages between mathematics teachers and other mathematics professionals in business and higher education, are described in the section

"Collaborative Sponsored Activities." Other activities made available to mathematics teachers by other local organizations and supported by the collaborative are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

Kick-off Dinner

The Memphis Urban Mathematics Collaborative "Kick-off" Dinner was held January 30, 1987, at Rhodes College. The activity was designed to present the current status of the collaborative, to offer opportunities for teachers to meet and mingle with college professors and business personnel involved with the collaborative, and to publicize and promote the projects the collaborative will sponsor during its first year. A cocktail dinner was followed by greetings from Project Director Nancy Gates, remarks from Molly Long, Chairman of the Memphis Urban League Board; remarks by Norm Webb of the Documentation Project; and a summary of collaborative progress to date by Dr. Marshall Jones, Advisory Committee Chairman and chairman of the Mathematics Department at Rhodes College. In addition, Dr. Thomas Barr of Rhodes College spoke on discrete mathematics.

Mathematics teachers from the twenty target schools were invited, as well as mathematics professors from local colleges and universities, representatives from nearly fifty business firms in the area, and several representatives from the School Board, including the superintendent and assistant superintendent. Attendance totaled 105, including approximately fifteen business representatives.

Teachers said the event was very worthwhile. One teacher commented, "I left inspired and with new ideas and things to do." Another commented, "I met with businessmen who were really helpful. I plan to get them for future talks. I was able to get names and phone numbers of contacts for future use. I really got some good ideas." A third admitted, "I went with real misgivings as a junior high mathematics teacher. I wondered if I would get anything out of this. But after the talk, I realized that I was laying the foundation for upper-division courses. . . The whole collaborative idea sounds great! The idea of bringing real world into the classroom is great and worthwhile if we can do it."

Overall, those surveyed were very supportive of the collaborative and enthusiastic about the dinner. Teachers considered the opportunity to make contacts with business and college personnel as one of those most valuable aspects of the event. One teacher said, "I met several college professors and businessmen who were quite cordial and even invited me to visit their business for a tour of how they used statistics and mathematics." A representative from Federal Express commented, "I am excited about the whole collaborative plan. I think there are many good projects being proposed; I hope we can all pull it off the ground."

Speakers Bureau

Based on information from a survey of potential speakers, the Speakers Bureau Subcommittee developed a roster of speakers from universities, businesses, and the school system who would be available to speak to mathematics classes or teacher groups on a variety of topics. The Speakers Bureau Directory, which was distributed in mid-February, contains biographical information on fifty-one speakers, and lists nearly seventy presentations the speakers are willing to make to classes, mathematics clubs, and mathematics teachers. The subcommittee will facilitate scheduling of presentations by making the contacts and serving as a liaison between the teachers and the speakers, and teachers are being encouraged to consider and use this resource as they develop their teaching plans. By the end of February, eight speakers had been scheduled in five schools; twelve additional requests for speakers had been made by late March.

The first speaker arranged by the subcommittee addressed more than 100 people in attendance at the Mu Alpha Theta Math Club's annual induction, held at Central High School on February 27. Dr. Tom Caplinger of Memphis State University spoke on "Math Trivia." Many favorable comments were heard from students, parents, and teachers.

Teachers have responded very favorably to the Speakers Bureau, although many felt too pressed for time during the school year to make use of it. One teacher said, "There are some great speakers and diverse topics in the directory. I really want to make use of it but it is so late in the year and I feel really pushed to finish the required topics in the curriculum guide. I plan to make more use of this service next year when I am not so hurried." Another teacher was impressed with the ease and comparative speed of the system: "It is great to see some efficiency that is designed to help the classroom teacher. We rarely see that."

Resource Associates Program

The Resource Associates Program was developed to foster one-to-one relationships between teachers and both college/university professors and mathematicians in business and industry. Initial plans called for identifying twenty industry/higher education mentors who would make a commitment to work with one or two teachers during the project year, providing teachers with opportunities to discuss teaching techniques, curriculum activities and business-related mathematics concepts.

The Resource Associates Subcommittee distributed questionnaires to teachers, college and university professors, and mathematicians in business and industry in order to identify what the teachers hoped to gain and what the mentors had to offer. Approximately forty-three teachers and thirty-eight professionals from the community expressed an interest in the program.

On February 23, 1987, the Subcommittee met to evaluate the teacher surveys, to pair teachers with resource associates, and to set guidelines and determine the steps necessary to initiate the program. In March, teachers were contacted to determine whether they were still interested in the program; those who expressed a willingness to participate were provided with the name and office telephone number of a college or business resource associate and were instructed to contact the associate to establish projects and time schedules. Thirty-seven pairings involving forty teachers were initiated. As in the case of the Speakers' Program Bureau, teachers said they would like to make better use of the Resource Associates Program but were pressed for time during the last few weeks of the school year.

Summer Workshops

The Summer Course Committee began its work in the fall of 1986 by developing a survey to obtain feedback from teachers about workshop topics that would interest them. The committee met February 12, 1987, to plan the workshops and courses for the summer of 1987. In response to the teacher survey, the collaborative decided to offer a series of four-hour, four-day workshops designed specifically to refresh teachers' skills and to present ideas about teaching. The general topics to be covered included algebra, geometry, probability, and mathematics across the curriculum. The majority of funding was to come from Title II funds, and the remainder from MUMC.

On February 26, the Summer Course Committee met again to finalize plans and to approve the syllabi for the summer workshops. Instructors were tentatively approved.

On April 23, course descriptions were distributed to teachers in the collaborative's target schools. Enrollment was limited to twenty teachers in each course, with registration on a first-come basis. On May 8, registration was opened to teachers outside the twenty target schools, and, as of June 1, 1987, all four workshops were full, with waiting lists of as many as twenty teachers. Teachers received a $192 stipend for attending each workshop.

Mathematics Across the Curriculum Workshop. On June 15-18, a workshop focusing on practical applications of mathematics in other fields was held at the State Technical Institute. Dr. Margie Hobbs and Dr. Cheryl Cleaves provided a survey of the applications of mathematics in the high school curriculum, focusing on the use of Algebra I, Algebra II, and Geometry in Chemistry, Physics, the social sciences, and vocational education courses. Nineteen Memphis City Schools mathematics teachers attended. The workshop was well received by participants, who almost unanimously rated it a 5 on a 5-point scale. One teacher said, "I feel this workshop broadened my perspective on the use of mathematics in the technological and vocational areas, especially the use of geometry and trigonometry." Another commented, "Kids are always asking what good this (math) will do them. Even if I don't have an application readily available, I know how to research it and find applications."

Probability Workshop. On June 15-19, Dr. Marshall Jones of Rhodes College presented a workshop on probability. Nineteen mathematics teachers attended. The workshop included an introduction of intuitive probability, simple finite probability spaces, probability laws and applications, counting problems, and probability distributions. Participants were pleased with the workshop, assigning it ratings of 4s and 5s on a 5-point scale. Those present complimented Dr. Jones' teaching skills, and reported that they had found the workshop very worthwhile. The on-site observer noted that "topics were explained in such a way that all teachers (with varying backgrounds) could understand."

Geometry Workshop. On June 23-26, Dr. Tom Caplinger of Memphis State University presented a workshop on geometry. The presentation featured an overview of major topics, with concentration on: algebraic and paragraph style proofs, three-dimensional concepts and relationships (including derivations of volume and surface area formulas), transformations, and enrichment activities with paper folding, tessellations, and problem solving. Seventeen mathematics teachers attended. While there was some feeling that the workshop focused too much on the "optional" student, the teachers felt they had benefitted from the presentation. One commented, "Dr. Caplinger is very knowledgeable and personable. As far as the topics, I don't believe I could possibly introduce these topics--except tessellations--to students at my school. I was expecting more ways to motivate the average student in geometry--not the optional."

Summer Internships

The Memphis Urban Mathematics Collaborative was successful in identifying four internships to be filled by teachers during the summer of 1987. A fifth internship was eliminated late in the planning process because of change in personnel at the local business and a concurrent reduction in the amount of money the business was willing to allocate to collaborative activities. The internships that will be provided include one with Memphis Light, Gas and Water; one with Commerce Investments Corporation; and two with the Army Corps of Engineers. As of the end of March, fourteen teachers had applied for these four positions. Interested teachers were required to fill out job application forms of the sponsoring organizations, and to participate in interviews that were initiated by the companies based on an applicants' background, interests and experience. Participating organizations selected their own intern from the pool of teachers they chose to interview: interns were paid directly by the sponsoring corporations. Following the internship program, participating teachers are expected to meet in September 1987 to discuss their experiences and to develop ways in which their experience could positively effect their teaching of mathematics.

COLLABORATIVE SUPPORTED ACTIVITIES

Teacher Initiative Grants

The Memphis Public Education Fund made Teacher Initiative Grants available to Memphis City Schools teachers to cover the costs of teacher-initiated projects designed to improve instruction, or to enhance the teaching-learning process, including fostering teachers' understanding of their subject areas. The collaborative reminded teachers that the grants also could be used to pay tuition for graduate or undergraduate classes at a college or university. Of the 230 applications processed, 149 grants were approved, including thirteen grants to MUMC mathematics teachers.

Emerging Trends in Mathematics

Emerging Trends, a conference sponsored by the Tennessee Department of Education which focused on academic challenges in mathematics, science and foreign languages, was held June 25. Although the activity was promoted by the collaborative, no more than five collaborative teachers attended. Sessions on mathematics focused on measurement and geometry in grades K-3, Project Equality in grades 7-12, advanced mathematics courses in grades 9-12, activities for applied mathematics in grades 9-12, organizations and projects for grades 5-12, and measurement geometry for grades 4-6. In addition, sessions were offered on the use of electronic gradebooks; mathematics in the legal, architectural, and engineering professions; the EQUALS program; and the Computer Software Resource Center.

F. Observations

The Memphis Urban Mathematics Collaborative experienced a very productive first year. Discussion of the progress of the collaborative will focus on four major areas: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The Memphis Urban Mathematics Collaborative is guided by an active Advisory Committee comprised of members who are committed to the collaborative and to improving the professional lives of mathematics teachers in Memphis. This committee has succeeded in identifying activities, in getting the collaborative underway, in understanding the development process and in recognizing the need for teachers to have more power. As the school year ended, the committee began to address the issue of encouraging teachers to take initiative for their own professional growth.

The structure of the Advisory Committee provides a good mix of people from business, higher education, schools, and the Urban League. The use of subcommittees, which are responsible for planning specific collaborative activities, has helped to foster a shared sense of purpose across these various groups. The Advisory Committee encourages one form of collaboration by actively involving representatives of the different sectors in common tasks.

The collaborative administration has made adjustments during the course of its first year of operations as the responsibilities of the executive director and project director become better defined and the support needed for the many tasks is identified. In general, Nancy Gates, the project director, was assigned responsibility for the day-to-day operations of the collaborative. Herman Ewing, executive director, was responsible for interactions with the Ford Foundation and for coordinating collaborative efforts with and making needed contacts through the Urban League. Ms. Gates occupies office space in the Urban League building and receives some clerical support from the League's staff.

As the year progressed, the level of work and time required to operate a collaborative became apparent. For example, organizing the Kick-Off Dinner required a considerable amount of Ms. Gates' time. She personally contacted nearly fifty Memphis and Nashville businesses, requesting them to send representatives to the dinner. As a result, the dinner was very successful--but its success may have established a pace and a set of expectations that would be very difficult for one person to maintain. The possibility of hiring an assistant to help with the details was discussed, but the action needed to get such help was slow in coming.

The Memphis Collaborative, as did other collaboratives during their first year, experienced a period of adjustment as the year progressed. The Urban League, with its long-range goal of raising the academic achievement levels of black underachievers in the Memphis Public Schools, worked to integrate the goals of the collaborative into its mission. Although the goals of the collaborative are consistent with those of the League, the orientation of the collaborative is directed towards promoting an environment of professionalism for all secondary mathematics teachers in the district that will improve the mathematics education of all students in the system. Thus, the League was assuming a different role than what it had assumed in the past. This meant that over the year the League had to address some new issues related to performing activities for teachers and raising funds for these activities. The collaborative's Executive Director, Herman Ewing, who is also the President and Chief Executive Officer of the League, was faced with the challenge of fulfilling the goals of the collaborative within the context of the Education Initiative of the National Urban League, the League's local fund-raising efforts, and the close cooperation of the school district.

Project Director Nancy Gates and the Advisory Committee assumed responsibility for planning and implementing the collaborative's activities. This group was faced with the challenge of gathering information from teachers, planning the various activities, and coordinating the participation of a number of people and groups. Ms. Gates was responsible for making the necessary contacts with people in business and seeing to the myriad details involved. She received some administrative support from the staff of the Urban League, who helped to prepare surveys and compile the Speakers Bureau resource guide. As the year evolved and more collaborative activities were developed, however, it became apparent that Ms. Gates would need more administrative help. The impressive number of activities initiated during this first year seems to have resulted from a combination of factors, including a very active Advisory Committee that includes representatives from higher education, industries, teachers, and the League, and the energy devoted to the project by Ms. Gates, who accepted the challenge of making the transition from classroom teaching to coordinating the project.

The Memphis Collaborative has made some changes based upon its experiences during the past year. To foster greater coordination between the collaborative and the Urban League, efforts will be made to include the collaborative's executive and project directors, the League's executive assistant, and the League's fiscal director in future planning. An administrative assistant will be hired in the fall to work nearly full time for Ms. Gates. The collaborative's executive director and project director will meet weekly to further the communications between and the coordination of collaborative operations within the administrative structure of the League. In addition, representatives from the district administration, the collaborative, and the Urban League will meet monthly. These meetings will facilitate collaborative administration by involving in the planning process those people who are able to make decisions necessary to acquiring appropriate administrative support for the collaborative. This executive group serves a function different from that of the Advisory Committee, which is primarily concerned with collaborative activities. It will be interesting to observe whether the adjustments made at the close of the 1986-87 school year will assist and improve collaborative operations in coming years and whether the high level of commitment to the collaborative demonstrated by all those involved will continue.

COLLABORATION

Collaboration in Memphis has assumed several forms. The Advisory Committee, as noted above, is one example of collaboration, with people from business, higher education, and the schools working together to plan activities for the collaborative and to address such key issues as increasing teacher involvement. Another form of collaboration is indicated by the efforts of representatives in business and higher education to provide resources to teachers, as demonstrated by the Speakers Bureau, the Resource Associates Program, and the summer workshops. A third form of collaboration involves the summer internships, in which teachers and representatives of business and industry work together. Through these internships, teachers have an opportunity to experience the ways mathematics is used in the world of work. One form of collaboration not yet apparent in Memphis--that among teachers--is expected to increase as teachers attend the summer workshops. The Advisory Committee is beginning to address the need to develop this form of collaboration as it discusses ways to encourage teachers to take the initiative in planning collaborative events. During its first year, the Memphis Collaborative made many contacts and formed substantial networks that will provide a solid foundation for future efforts.

TEACHER PROFESSIONALISM

Teachers in Memphis are greatly influenced by such state mandates as the career ladder program. The need to accumulate the hours that determine teachers' position on this ladder influences how teachers are willing to spend their out-of-school time. Teachers' approach to the collaborative within this context will provide a good indication of how they view teaching as a profession. Teachers, particularly those who have reached the third level and have a twelve-month contract, have expressed support of the career ladder system. Others feel the ladder is there if they want to work for it, but that the increase in benefits is not sufficient to induce them to go through all of the steps. Teachers who participate in collaborative activities that do not contribute hours required by the career ladder demonstrate an especially strong commitment to their profession. Teachers who work within the system so that as many collaborative activities as possible count toward the career ladder will demonstrate a different kind of empowerment.

During the past year, teachers have demonstrated some interest in improving their professional lives. They expressed strong interest in the summer workshops, and several teachers applied for and received Teacher Initiative Grants. Because several of the activities became available toward the end of the school year, many felt they had limited opportunity to take advantage of the resources provided. It is important to note that the collaborative has developed a variety of activities during its first year that have affected many teachers and have the potential of affecting many more. The collaborative is providing the opportunity for teachers to plan and to help other teachers, rather than relying exclusively on administrators for in-service activities.

MATHEMATICS FOCUS

Teachers during the 1986-87 school year have benefited from activities involving a variety of mathematics topics. The Kick-Off Dinner presentation focused on discrete mathematics. Summer workshop topics were selected based on teachers' expressed interest in their content areas. The four topics, algebra, probability, geometry, and a survey of applications of mathematics, were chosen to specifically help teachers improve their classroom experiences. The Speakers Bureau and the Resource Associates Program both provide resources that will focus on the application of mathematics and other topics that may be requested to meet specific needs.

The collaborative leadership has a strong background in mathematics and mathematics education. Both Nancy Gates and Herman Ewing have taught mathematics. The chair of the Advisory Committee, Dr. Marshall Jones, is a member of the Rhodes College Department of Mathematics. They are in a good position to ensure that collaborative activities include events that meet the mathematical needs of district teachers.

G. Next Steps

During the 1987-88 school year, the collaborative will expand its target population to include all of the approximately 345 mathematics teachers in the Memphis Public Schools.

Teacher Committee

A Teacher Committee will be appointed for the 1987-88 school year. This committee will include thirteen teachers, the project director, the on-site observer, and the mathematics consultant. The thirteen teachers will be selected from the sixty to seventy teachers who expressed interest in participating in the collaborative during the 1987-88 school year. Teachers will be selected by members of the Advisory Committee so as to assure a balance in committee membership in gender, race, and grade level being taught.

The first meeting of the committee, which will meet once every six weeks, will be in September, 1987. The Teacher Committee will serve as a conduit for information between teachers and the collaborative. The committee also will provide the opportunity for teachers from junior high schools to talk with teachers from senior high schools.

Newsletter

The collaborative will begin to publish a quarterly newsletter that will be sent to approximately 250 teachers and to businesses in the Memphis area as an appeal for their support. Initially, the collaborative will hire an editor to produce the newsletter, which will be printed by the Board of Education.

Swap Shops

Swap Shops on six topics are scheduled for the first week in December, 1987 to allow teachers who are teaching the same class to meet with one another and discuss ideas.

Workshops are planned for teachers of Algebra I, Algebra II, Advanced Mathematics, seventh and eighth grade mathematics, ninth grade Applied Mathematics, and Geometry. The ideas discussed in each workshop will be recorded and compiled in a document that will be distributed at a district in-service day scheduled January 27, 1988.

The six teachers who have been selected to lead the Swap Shops will meet with Margie Hobbs and Cheryl Cleaves on Saturday, November 14, to plan the workshops. Each leader will be paid a stipend of $50.

Algebra Workshop

The Algebra Workshop, the last of the series of four-hour, four-day workshops offered to teachers this summer, will be held at Rhodes College. Dr. Ken Williams of Rhodes College will focus on a functional approach to algebraic concepts, including linear, polynomial, rational, inverse, exponential, and logarithmic functions, and techniques in graphing and problem solving. The workshop will provide teachers with a more unified functional view of algebra.

Workshop and Conference Attendance

The collaborative will sponsor three teachers to attend the North Carolina School of Science and Mathematics (NCSSM) 1987 summer workshop. These teachers will become familiar with the pre-calculus curriculum developed at NCSSM and will be expected to lead workshops on the topic for their Memphis colleagues during the 1987-88 school year.

TERM Project

During the summer of 1987, LeMoyne-Owen College is planning to offer a five-week workshop that includes academic year follow-up and support. Project TERM (Teacher Enrichment and Reinforcement in Mathematics) is funded by the National Science Foundation and is working through the collaborative to encourage teachers to attend. The five-week workshop will include instruction in discrete mathematics and basic programming, as well as daily sessions on mathematics problem solving and mathematics applications. Projects that relate specific mathematics topics to the secondary school classroom will be initiated in the workshop and implemented as part of regular teaching assignments during the 1987-88 school year. Participants will report on the progress of the projects during one-day mini-conferences in December, 1987, and June, 1988. The workshop will carry six hours of tuition-free undergraduate credit and provide participants a stipend of $1,000. The workshop will be open to teachers who: 1) are not certified to teach mathematics, 2) did not major in mathematics on the college level, 3) have taught no more than 50 percent of the secondary curriculum, or 4) have no more than five years of mathematics teaching experience.

SUMMARY REPORT:
NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the New Orleans Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Metropolitan Area Committee Foundation; documents and interview information provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; a retrospective interview with Barbara Nelson of the Ford Foundation; and four site visits by the staff of the Documentation Project.

NEW ORLEANS MATHEMATICS COLLABORATIVE (NOMC)

A. Purpose

As stated in the proposal submitted to the Ford Foundation, the goal of the New Orleans Mathematics Collaborative (NOMC) is to enhance the professional development of secondary school mathematics teachers in the Orleans Parish Public Schools and to enrich the teaching of mathematics by providing opportunities for teachers:

1. to become part of a network of mathematicians;
2. to work in collaboration with mathematics teachers and other mathematicians in addressing both teacher and student needs;
3. to keep abreast of developments in the fields of mathematics and teaching; and
4. to experience firsthand the ways in which mathematics is used outside the academic setting.

B. Context

New Orleans is a city of approximately 536,300. The public school system reflects the unique demographics of its inner-city residents. Due to the migration of the white population in the 1950s and 1960s, residents of the core inner city are predominantly young, poor, and black, with many families headed by single women. The sharp increase of young mothers with elementary school-age children, is a trend that is expected to continue. In fact, New Orleans' poverty rate in 1980 ranked third among large cities, with 26.4 percent of its citizens living beneath poverty level. At that time, twice as many families and children in New Orleans lived below the poverty level as in the country as a whole. Barely 50 percent of students entering public schools graduate from high school, with the highest number of dropouts in the ninth and tenth grades.

Dr. Everett J. Williams is the superintendent of the Orleans Parish Public Schools (OPPS), which is comprised of 140 schools. There are an additional 104 nonpublic schools (private and parochial) in the Orleans Parish. New Orleans has nineteen public high schools, of which seventeen are traditional, and two are "second chance" schools for potential dropouts. Three of the traditional high schools are vocational schools; the elective courses taken by students in these schools generally are concentrated in one vocational area. Students who graduate from the vocational schools must meet the same academic standards as students from the other schools.

Fifty-seven percent of the $218.525 million budget for the public schools during 1986-87 came from state and federal funds, with the state bearing the major fiscal responsibility for primary and secondary schools. Funds from the district's three major sources--local, state, and federal governments--are all decreasing. While New Orleans residents do have one of the highest sales taxes in the nation, the majority of homeowners in New Orleans Parish pay no property taxes as a result of low home value assessments and high tax exemptions. Voters have refused to pass new levies. Major revenues for the area come from the petroleum industry and tourism.

During the 1986-87 school year, 83,601 students were enrolled in grades K-12, a decrease of 565 students over 1985-86. Of these students, approximately 86 percent were black; 9 percent were white; and 5 percent were Asian, Hispanic or American Indian. Thirty percent of the students are in families that receive Aid to Families with Dependent Children (AFDC) and are, therefore, eligible for Chapter I funds. Additionally, 73 percent are eligible for the free lunch program. The average class size is twenty-eight students in the elementary grades, and twenty-five students in the secondary grades.

In 1985-86, there were 4,507 public school teachers in the Orleans Parish, 2,604, or 59 percent, of whom were black females. There are 248 mathematics teachers in the secondary schools, which include middle (grades 6-8), junior high (grades 7-9) and senior high (grades 9-12, or 10-12). Of these mathematics teachers, more than 223 are fully certified; 186 tenured (three or more years of service); 7 temporary; and 18 are non-certified. One mathematics teacher holds a doctorate, 38 hold masters degrees plus thirty hours, 57 hold masters degrees, one has a specialist degree, and 151 hold bachelor degrees. Teaching salaries range from $16,032 for a beginning teacher with a B.A. degree to $26,210 for a teacher with a doctorate degree. The collaborative's target group includes the district's nearly 150 senior high mathematics teachers.

Students in the graduating class of 1989 and thereafter are required to take one unit each in Algebra I, Algebra II, and Geometry for graduation. These courses are offered at three levels: regular, honors, and gifted. Remedial courses include Introduction to Algebra, Consumer Mathematics, and Business Mathematics. Courses for advanced students include Trigonometry, Advanced Mathematics, Calculus and College-Level Calculus. In addition, Computer Science I and II, and College-Level Advanced-Placement Computer Science are available.

Standardized test scores have been increasing for the last three years. On the Comprehensive Test of Basic Skills (CTBS) administered in 1986-87, 73.4 percent of students scored at or above the 25th percentile.

The mean ACT score of the 1987 New Orleans public school graduating class was 12.8 percent, compared to the national average of 18.7. (The range of possible scores was 1 through 36.) Louisiana state universities, all of which have open admission, require students with ACT scores lower than 16 to take remedial mathematics at the beginning of their college careers.

C. Establishment of the Collaborative

The Metropolitan Area Committee (MAC) Foundation is the funding agent for the New Orleans collaborative. The committee is a nonprofit, citizens' action organization whose membership includes representatives of business, labor, professional, academic, and religious communities in the greater New Orleans area. MAC, founded in 1966 by a biracial group of community leaders, sponsors a wide range of civic and educational activities in New Orleans.

The MAC Education Fund, a project of the MAC Foundation, was established in December, 1985, with a grant from the Pittsburgh-based Public Education Fund. In fall, 1985, the Ford Foundation approached Dr. Norman Francis, president of Xavier University in New Orleans and chairman of the MAC Education Fund, with the idea of creating a mathematics collaborative in New Orleans. Dr. Francis noted that the Metropolitan Area Committee was in the process of establishing a local public education fund and that this would be an appropriate host agency. However, because a large staff effort would be required to initiate the local public education fund, Dr. Francis suggested that the development of a collaborative should wait until the fund was established. Individuals on the MAC Education Fund continued to gather more information about collaboratives and to stimulate interest in the project among teachers and others in the community.

After extensive discussion with several MAC members, Barbara Nelson of the Ford Foundation met in spring, 1986, with members of the MAC Education Fund board, which included representatives from local corporations, businesses, and universities. This group's willingness to commit itself to the effort was instrumental in the decision to proceed with the development of a collaborative. The MAC Foundation received a three-month planning grant of $2,500 from the Ford Foundation. A planning group was established, consisting of representatives of OPPS, the teachers' union, professors and administrators from local universities, and leaders from the business community. The involvement of a wide variety of organizations in the planning process has been a key factor in establishing community-wide ownership of the project and in expediting the implementation of the collaborative's initial activities. On August 1, the MAC Foundation submitted a proposal to the Ford Foundation for the establishment of an urban mathematics collaborative with a start-up date of September 1, 1986.

The collaborative is comprised of OPPS, the teachers' union, three universities, the Louisiana Science Centre, and six businesses and corporations. Involvement of three other universities and additional business and community organizations has been initiated. The collaborative's program is organized into three basic components: out-of-school professional activities, in-school activities, and networking.

Constance Barkley, director of the MAC Education Fund, serves as the collaborative's project director. Olympia Boucree, a former mathematics teacher and mathematics supervisor for the Orleans Parish Schools, is project coordinator. Sally Hayes, executive director of MAC, also provided important administrative support. The on-site observer is Aldonia Winn, a former mathematics teacher who in January, 1987, became a Chapter I resource teacher.

The collaborative is governed by a Steering Committee of twenty members, including mathematics teachers, school system administrators, and representatives from the teachers' union, local businesses, universities, and the Louisiana Science Centre. Dr. Richard Hays who chaired the Steering Committee in 1986-87, also served on the MAC Education Fund Board. The Steering Committee, which meets quarterly, monitors and evaluates programs, and serves as a think tank to solve problems and create new initiatives. Four subcommittees oversee the activity areas: symposia; site visits and internships (including university courses); workshops; and the newsletter. Each subcommittee is responsible for implementing appropriate programs, recommending modifications based on program experiences, and generating ideas for new collaborative activities.

The symposia subcommittee planned and evaluated symposia in December and April. The workshop subcommittee plans workshops to which all mathematics teachers in the New Orleans public schools are invited. The site visit/internship subcommittee contacts companies, universities, and other institutions for a commitment to host site visits, sponsor an intern, and/or visit a New Orleans public school. The newsletter subcommittee is composed of designated newsletter coordinators from the other three subcommittees. Two issues of the New Orleans Mathematics Collaborative Newsletter were published in the 1986-87 school year, with the first edition appearing in January, 1987.

At the Steering Committee meeting on February 9, 1987, Dr. Mark Driscoll, director of the UMC Technical Assistance Project at the Education Development Center, shared information from other collaboratives and discussed the January 15-16 Mathematics Symposium in Washington, D.C. Dr. Driscoll emphasized the role of EDC in helping the NOMC in its endeavors and also expressed his view that current problems in mathematics education stem not from the quality of teaching, but from fundamental problems in the curriculum. He stressed the need to consider mathematics as a viable, dynamic body of knowledge and explained that site visits to industry could provide teachers an opportunity to view mathematics from different perspectives. The subcommittees in charge of symposia, site visits, workshops, and the newsletter reported on their activities, and Constance Barkley reported on mini-grants.

At the May 18 Steering Committee meeting, at the Liberty Bank, the teacher evaluations of the first year of the collaborative, given at a May 11 meeting, were discussed. As at the other Steering Committee meetings, Richard Hays led the discussion. The values of the different type of activities--site visits, symposiums, and workshops--were discussed and a draft of the second year proposal was outlined. Committee members decided they did not want to make any drastic changes in the proposal and suggested that the staff from MAC should go ahead and write the proposal with input from teachers. On June 15, the Steering Committee met to review the proposal for continued funding, to be submitted to the Ford Foundation, which was prepared by the MAC staff. The proposal was approved.

D. Relationship with Other Local Initiatives

Resources available to the collaborative include the Louisiana Science Centre; the nationwide network of Ford Foundation-supported urban mathematics collaboratives; professional organizations in mathematics-related fields, including the MAC Education Fund; and the local Council of Teachers of Mathematics. An effort is being made to maintain a high community profile through effective use of the media, the collaborative newsletter, and business, university, and school-system publications.

The MAC Education Fund, developed in 1985, is a project of MAC. The New Orleans Mathematics Collaborative is the fourth program to be coordinated by the MAC Education Fund. The other current programs of the education fund are "Partnerships in Education," "Mini-Grants for Teachers," and "Community Awareness."

The Partnerships in Education program provides an opportunity for business- and private-sector organizations to become involved in public education through concentration on the needs of an individual school. Through these partnerships, schools expand their available resources and enhance their understanding of the needs and concerns of business. During the summer of 1986, five teachers were guests of the U.S. Army in a visit to Fort Sill, Oklahoma, where they observed the mathematics the Army was using. Another outcome from the Partnerships program is that some teachers received mini-grants from the business partner for their schools.

The mini-grant program provides teachers with the resources to explore new teaching techniques and to develop creative projects to benefit their students. Grants of up to $500 per teacher are awarded in the fall and spring semesters, with an implementation period of up to twelve months. During the 1986-87 school year, $10,000 was reserved for mathematics projects.

The MAC Education Fund's community awareness program is designed to improve citizen awareness of the needs of and the challenges facing the New Orleans public schools. The program is sorely needed in New Orleans, where 80 percent of the city's households have little or no contact with the public schools because of a combination of factors, including children attending private or Catholic schools and parents who don't get involved in their children's education. The isolation of citizens from the schools is reflected in the confusion which surrounds many public-school issues. For example, the public schools' lack of a constituency has meant that recent tax levies on the ballot have all failed to pass.

The newly established Louisiana Science Centre has been very supportive of the collaborative. The Centre, originally established by the New Orleans Chamber of Commerce as a project of the business community, is designed to teach basic science and mathematics to the public through thematic exhibits, coursework, and daily classes. At the end of the 1986-87 school year, the Centre was negotiating with the city and the Port of Orleans for a building located on the banks of the Mississippi River in the area of the 1983 World's Fair. During the year, the small staff of three or four operated out of temporary quarters. Because much of the Centre's staff time during the year was devoted to attaining a lease at a new Centre site, the staff was unable to fulfill its plan to provide some workshops for mathematics teachers.

E. Project Activities

During the 1986-87 school year, the New Orleans Mathematics Collaborative sponsored a variety of activities to provide teachers the opportunity to form networks with their peers, to keep abreast of developments in the fields of mathematics and teaching, to work collaboratively with other teachers and mathematicians and to experience firsthand the ways in which mathematics is used outside the academic setting. These activities are described in the section "Collaborative Sponsored Activities."

The collaborative also encouraged teachers to participate in the Mini-grant Program sponsored by the Education Fund of the Metropolitan Area Committee and in a workshop the collaborative co-hosted with Loyola University. These activities are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

Opening Reception

A reception to officially launch the New Orleans Mathematics Collaborative was held November 18, 1986, at the Louisiana Science Centre in the Cenote of Sacrifice exhibit. This was a temporary exhibit erected in rental space to provide the public with an idea of what the Science Centre may do. The Science Centre provided the space and the collaborative paid for the food. Teachers, principals and school district personnel were invited, along with the media and key representatives of the New Orleans business and university communities. Between forty and fifty people attended, including teachers, principals and other school administrators, and representatives of businesses, universities and community groups.

Symposia

On December 4, 1986, NOMC sponsored its kick-off symposium, "Mathematics for All," at the Holiday Inn Crowne Plaza. Dr. Jack Cawley, professor of mathematics at the University of New Orleans, spoke on the use of mathematics. A panel discussion involving Merle Harris, a teacher, and Jonathan Lifa of Chevron U.S.A., followed the presentation. Attendance was very good: of the 118 persons who made reservations, 106 attended. Approximately 75 percent were teachers; the remainder were representatives from businesses and universities. Seventy-four participants evaluated the symposium; respondents included forty-six teachers, twelve business representatives, seven university professors, and nine administrators. The overall evaluation was very positive. One person wrote, "We need more gatherings like this so that math teachers and business people can discuss educational issues that are of mutual interest to both groups. The discussion segment allows teachers to focus on specific mathematical needs and concerns of the business sector." Another noted, "Long overdue." A third participant observed that the symposium was "refreshing and informative."

The second symposium was held April 23, 1987, at the Plimsoll Club in New Orleans. Dr. Ross Finney, senior lecturer in Mathematics at MIT, spoke on "Professional Applications of Precalculus Mathematics." Dr. Finney focused on mathematical modeling and used several intriguing examples such as card tricks and legislative turnover to motivate the creation of mathematical models using linear algebra, logarithmic and exponential functions, and probability and statistics. After dinner, Dr. Matthew Proctor, Deputy Superintendent of the Orleans Parish Public Schools, spoke, and Brian Decuir, a teacher at McDonough 35 Senior High School, and Michael Grumich, Senior Analyst at Louisiana Power and Light/New Orleans Public Service, Inc., responded. Approximately eighty teachers and thirty-three business and university representatives, as well as several administrators from OPPS, attended the symposium.

Sixteen of the seventeen target high schools were represented at the symposia, which were viewed as having been very successful.

Department Chairs' Meeting

A meeting of all mathematics department chairpersons from the OPPS senior high schools of the New Orleans Parish Schools was held January 8, 1987, at the Lakeview Administrative Center to inform department chairpersons about NOMC and the role of the on-site observer. The activity was organized by Maric Kaigler, the Mathematics Specialist for the Orleans Parish Public Schools. Seventeen mathematics department chairpersons attended and heard a presentation by Dr. Olympia Boucree, the project coordinator. At the meeting teacher surveys were distributed and the procedures for having teachers complete the surveys and return them were discussed.

Site Visits

The New Orleans Mathematics Collaborative arranged four site visits to businesses and industries during the 1986-87 school year. OPPS provided release time so teachers could participate and acquire practical information to apply to their classroom teaching. Olympia Boucree contacted each business that agreed to have a site visit and told them of what the collaborative expected from the visit. The businesses then planned the agenda and activities for the day, including lunch for the teachers. While approximately fifty-five teachers expressed interest in participating in a site visit, there was space for only twenty-eight. The mathematics department chairs at each of the seventeen senior high schools and at the ten junior high schools were asked to designate a teacher from each school to attend one of the site visits. A total of twenty-two teachers actually were able to take advantage of this activity.

New Orleans Public Service Site Visit. On March 11, 1987, six teachers from the Orleans Parish Public Schools participated in a one-day visit to New Orleans Public Service Inc. (NOPSI) and Louisiana Power and Light (LP&L). The teachers heard presentations on load research, system planning, forecasting, and marketing, and also toured the Skills Center, where engineers and maintenance personnel responsible for the nuclear facility are trained. The visit included a discussion of mathematics training needed by employees and the ways in which mathematics is used in the public utilities industry. The high quality of the program's visual materials prompted teachers to discuss how they could emulate the visual presentations in their classrooms. They received materials, graphics, and outlines which could be duplicated for classroom use. One teacher observed, "Everything presented today was very enjoyable. Each presenter left me with several ways of alerting my students about the need to pursue their math studies." The teachers' only negative comments involved the lack of time and the distance they had to travel to visit the facilities (a one-hour drive each way)--both circumstances they realized couldn't be helped.

One teacher, who wrote her impressions of the site visit in an article which appeared in the second edition of the NOMC Newsletter, said, "I was amazed at the range of mathematics topics used. Employees used knowledge from Math I to Trigonometry and Calculus. The speakers emphasized to us that rote knowledge alone is not good enough. The speakers said, 'They have computers for rote knowledge. An employee must know how to interpret mathematical results.'" The teacher also observed that the list of mathematics skills taught and used at Waterford 3, the nuclear facility, resembled the Expected Learner Outcomes which are minimum Learner objectives established by the Parish within guidelines from the state.

Michael Grumich, Senior Analyst for LP&L and NOPSI, also commented on the site visit in the same issue of the newsletter. He wrote, "The employees of LP&L and NOPSI who were involved in the program for the visiting teachers commented positively on having the opportunity to share the mathematical skills and tools of the work place. Everyone remembers studying mathematics in high school and not being able to fully understand how the pieces fit into the bigger picture of the real world. The true appreciation of the integral nature of mathematics within the engineering discipline and all other technical fields comes with many years of practical applications. Presentations to visiting teachers provided a reappreciation of the logical and mathematical processes utilized daily in carrying out the responsibility to provide dependable electrical service to the customers."

Shell Offshore Site Visit. A site visit to Shell Offshore Incorporated was held March 19, 1987. Five high school mathematics teachers and the on-site observer heard presentations on the use of mathematics in the oil industry. Topics included, "Well Design and Directional Surveys," "Geological Data Base," "Probability and Decision Trees," "Well Testing," "Seismic Exploration," "Data Processing," "Interpretation," and "3D Workstation." Shell provided lunch for the group.

The program was extremely well received. One teacher commented, "Presentations were excellent and related job and job requirements to the type of mathematics at higher levels, but based on the foundation of courses in high school." Another teacher stated that the program was "worth my time and my students' time."

A third said, "Presenters were courteous, personable and a pleasure to be around. They provided a peer-type relationship rather than one that was superior." One teacher summarized his comments by saying, "Basically, I can only praise Shell Oil for its effort."

Freeport-McMoRan Site Visit. A site visit to Freeport-McMoRan, Inc., a worldwide corporation comprised of companies ranging from mining to manufacturing, was held March 25, 1987. Five mathematics teachers, each from a different junior high school, heard presentations on the use of the mathematics taught in junior high schools in the business world. The teachers who attended were very pleased with the visit and found it both informative and interesting. One teacher said, "I came to a company about which I knew very little and learned a great deal to take back to my school." A second noted, "The visit was well organized. The jobs discussed covered all levels of math from basic and general concepts to the higher levels of math." All five teachers felt that they could relate the mathematics applications they had observed to the mathematics curriculum. As one teacher said, "The mathematics models were practical and should be easy to present to students."

Consolidated Natural Gas Site Visit. A site visit to the Consolidated Natural Gas Company on April 13, 1987, offered five teachers several examples of how basic mathematics is used in accounting, and how applied and finite mathematics are used in engineering. The program consisted of lectures and did not include tours or hands-on experience, which most teachers later indicated that they would have preferred. The discussion included examples from trigonometry, geometry, basic mathematics, algebra, physics, accounting, and calculus. Teachers noted that none of the speakers were women or minorities.

Workshops

The New Orleans Mathematics Collaborative conducted three of the Orleans Parish Public Schools' mandated workshops during the 1986-87 school year. Twenty-six teachers participated in these workshops.

Problem Solving Workshop. An in-service workshop on problem solving sponsored by OPPS Staff Development was held February 19, 1987, at Kennedy Senior High School. Eight teachers attended. Dr. Yvelyne Germaine-McCarthy, a mathematics teacher at Benjamin Franklin, presented material on problem solving. The material was generally well received. One teacher commented that the presentation was "thought provoking and had everyone involved." Another said, "Most OPPS workshops are a waste of time--a repeat of what I know. This is the first one I can actually say that I learned a lot from. Keep up the good work!" A third teacher stated, "What a delightful way to learn and/or review!" This workshop was arranged by the district on one of its mandatory in-service days. By request of the mathematics supervisor, the collaborative identified the topic, planned and arranged for the speaker and promoted and advertised the activity. The workshop topic was culled from evaluation forms collected at the collaborative symposium.

Any teacher in the school system could attend any of the scheduled workshops on that day. Consequently, some elementary teachers attended, and felt that the material was too advanced for their needs, but believed that some of the handouts could be adapted. One teacher suggested that the planners should "check the grade level of the participants and gear the problems to it."

Mathematics Anxiety Workshop. The collaborative arranged for a speaker and advertised an in-service workshop on mathematics anxiety held February 20, 1987, at Kohn Jr. High School. Dr. Joanie Steinberg, a professor at Tulane University, presented materials on mathematics anxiety to ten teachers. The attendance was lower than anticipated. Participants were very involved and seemed to enjoy themselves.

Using Computers and Calculators in the Classroom. On May 2, 1987, the collaborative sponsored a three-hour Saturday workshop on the use of calculators and computers in the classroom, directed by Dr. Antonio Lopez of Loyola University. While there was space in the workshop for thirty participants, only eight actually attended. This was the Saturday following the Thursday night symposium. All teachers were invited to attend the workshop, but because of its closeness in time to the symposium, the attendance was lower than expected.

The collaborative's Steering Committee recognized that the workshops were less popular among teachers than other NOMC activities. It also is aware of the need to determine those topics that are of most interest to teachers. In addition, the teachers suggested that perhaps the sessions would be more appealing if they were not called workshops, but instead promoted as "seminars" or "mini-courses."

Teacher Evaluation Meeting

On May 11, 1987, the NOMC sponsored a meeting at the Liberty Bank to allow teachers an opportunity to evaluate the first year of the collaborative. All mathematics teachers were invited. Eleven district teachers attended, as well as three from MAC (Olympia Boucree, Constance Barkley, and Sally Hayes), and two representatives from the Steering Committee (Richard Hays and Ron

Masters). The teachers commented on those aspects of the collaborative they appreciated and made suggestions for changes and improvements. Teachers stressed that they need to meet with people from business and universities to hear about what will be expected of students graduating from high school. The group recommended that the symposium should be continued, but that the topics should have a wider appeal. The site visits should include more teachers and the teachers who attend should share the information received with other teachers and students in their school. The workshops should be referred to by some other name. Teachers should meet to formulate a cohesive policy statement about "where we are as math teachers" rather than attend workshops. One action taken by the collaborative, based on the reactions of teachers at the meeting, was to form a Teacher Advisory Council beginning in the fall, 1987.

Collaborative Newsletter

Two issues of the New Orleans Mathematics Collaborative Newsletter were distributed to approximately 150 mathematics teachers in the New Orleans public secondary schools during the 1986-87 school year. The Newsletter announced upcoming events, reported on past collaborative activities, and served as a vehicle for teachers and business representatives to express their views on collaboration. In 1986-87, the Newsletter was edited by Merle Harris, who originally chaired the Newsletter Committee. At the end of the school year, with Ms. Harris leaving the district, Ella Butler was appointed as the new editor. Ms. Butler is a mathematics teacher at Rabouin Vocational High School.

COLLABORATIVE SUPPORTED ACTIVITIES

Mini-grants

The collaborative encouraged and supported teachers to make use of the Mini-grant Program of the Metropolitan Area Committee Education Fund. In the 1986-87 school year, $10,000 was reserved to fund mathematics-related projects at all grade levels. During the first round, six mini-grants totaling $2,793 were awarded to teachers in the New Orleans public schools for mathematics-related projects. A total of 330 proposals were submitted by teachers from all content areas. One criteria required that the proposed project was innovative. Ella Butler, a teacher at Rabouin Vocational High School, is using her $500 mini-grant to teach students mathematics in a way which will directly relate what they learn from their textbook to the mathematics they will use in future jobs. She will also give students opportunities to learn about mathematics-related careers. Willie Hampton, a teacher at Booker T. Washington High School, is using his $500 mini-grant to establish a Mathematics

Applications Room to be used by all teachers and students on a rotating basis. Teachers will bring their classes to the room to acquire hands-on experience in mathematical concepts. Four other mini-grants were awarded to elementary school teachers for projects related to manipulatives, working with parents on problem solving, improving students' logical thinking skills, and using mathematics in a small business.

Two hundred applications from all content area teachers have been received for the second round of mini-grant awards, which will be announced in July, 1987.

Reception and Lecture

On Monday, April 13, the collaborative and the Department of Mathematical Sciences of Loyola University co-hosted a reception and a lecture by Dr. C. C. Rousseau of Memphis State University. Dr. Rousseau, who coaches teams for the International Mathematical Olympiad, lectured on the competition and presented some of the Olympiad problems. Because of excessive rain, nobody from the collaborative attended.

F. Observations

During its first year, the New Orleans Mathematics Collaborative implemented a number of activities and established its organizational administration. Discussion of the collaborative's growth during the year is organized into four sections: Project Management, Collaboration, Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The collaborative's direction is provided by the Steering Committee, which meets regularly and has been actively involved in preparing the original and refunding proposals. The daily operations of the collaborative are overseen by the director, Constance Barkley, and the coordinator, Olympia Boucree. Sally Hayes, Executive Vice President of MAC, was very involved in the collaborative during its first year and contributed her leadership and experience when needed. These three administrators had adjacent office space, which facilitated communication among them. During the year, the three moved to a larger area in another part of the FNBC Building. As a result, more room was available for the general operations of the MAC and the collaborative at the same time these collaborative leaders will be able to maintain adjacent offices.

The director and coordinator of the collaborative share a vision of the collaborative's progression over the next five years. They see the collaborative developing in stages, from an initial recognition stage where teachers become comfortable with the collaborative, to a development stage where teachers struggle to take control of making change happen, and finally to a change stage where there has been actual changes in what teachers do.

Because of the depressed economy in New Orleans and in Louisiana in general, fund raising has been very difficult. The collaborative, however, succeeded in attaining commitments for the funds necessary for the next two-year proposal to the Ford Foundation. The funds came from the school district (22 percent), universities (17 Percent), businesses (48 percent), and other organizations (13 percent). The collaborative's goal is that over these next two years, the project's demonstrable outcomes will be sufficient to convince an increasing number of local groups of the project's viability to the extent that they will be willing to contribute to its financial support. Concurrently, another collaborative strategy encourages teachers, business people, and academicians to interact professionally in order to engender in them a sense of responsibility for their own networking and professional relationships.

The New Orleans collaborative has accomplished its first year goal of developing community awareness of its existence. Nearly two-thirds of local public school teachers participated in one or more of the collaborative's activities, and the project successfully fostered the meaningful involvement of representatives from all sectors. As the collaborative enters its second year, it must expand its sphere of influence among teachers and increase the degree of participation of people from business and higher education. When Sally Hayes leaves MAC in September, 1987, some of her responsibilities will be assumed by the project director; in addition, the director will assume increasing leadership responsibilities related to the MAC Education Fund. As a result, the degree of close attention that the director will be able to devote to the collaborative is questionable. Perhaps the durability of an organization is most tested when there is a change in key people. This is to be observed over the next year in New Orleans.

COLLABORATION

Collaboration is happening in New Orleans. People in all sectors have been very active in planning and attending activities. The Steering Committee, composed of representatives from business, higher education, and schools, has fostered a high level of collaboration, with all participants serving as equals. Decisions are made by the subcommittees and the larger group. The influence of the combined efforts was evident at the symposium; there was a large attendance of those from outside of education and at least one person from each sector participated in the program. Participation of school district administrators is also noteworthy. The superintendent of schools, or his representative, attended each of the two symposiums sponsored by the collaborative. Furthermore, Marie Kaigler, the district's mathematics supervisor, is very active in planning and participating in collaborative events.

Those in higher education and business who have worked with the collaborative are very committed to helping improve the New Orleans educational system. Teachers and representatives from business and higher education are all very much aware of the condition of education in New Orleans and its reputation both locally and nationally. They see that the improvement of education will mean an overall improvement in the economic and social conditions of the region. Therefore, several very dedicated people are working with the collaborative to make change happen. One engineer who recently moved to the area from California became involved because he observed the positive effect business involvement could have on minority student achievement through their participation in MESA, the Mathematics, Engineering, and Science Association. Another former mathematics teacher who is currently working for a local corporation explained that it was "good business to have a strong public education system, so that people from out of state can be attracted to work in New Orleans." An economics professor at the University of New Orleans wrote, "Metro areas with spirited, enterprising leadership are generally those with well-managed and adequately funded school systems. The delivery of the government service of public education is an enterprise which requires broad community participation and the highest calibre of management." The Steering Committee observed in working with businesses and companies that the greatest help and participation came from individuals usually at the middle management or technical level, rather than at the level of the chief executive officer.

Another form of collaboration apparent in the first year of the New Orleans collaborative is the role of business representatives and university professors as resources. This is most evident in the site visits and the workshops, where business people and university professors have talked about applications in mathematics, problem solving, calculators, and computers.

NOMC teachers, particularly those serving on the Steering subcommittees, have also worked cooperatively. The symposia have provided teachers with an opportunity to meet and become better acquainted. Some local mathematics teachers are also very active in the Louisiana Council of Teachers of Mathematics, while others are active in union and political affairs. For example, this past year, several teachers participated in a Baton Rouge rally in support of more state funding of education.

Teachers will have more of an opportunity for collaboration as the Teacher Advisory Council is formed and becomes active. As evidenced by the experience of the other collaboratives, such a group generally develops a sense of cohension and sharing that can be very meaningful to participants. The TAC has the potential of establishing a core of teachers from which significant collaboration among teachers can be built. Issues to be considered with the growth of the TAC include whether to rotate membership, and how to offer this positive experience to a wider group of teachers.

Some forms of collaboration envisioned in the original proposal have not evolved. One such relationship that has been slow to develop is that between the Louisiana Science Centre and the NOMC. The Centre has experienced problems in establishing permanent space as a result of a bureaucratic entanglement between the City and the Port of New Orleans regarding ownership of the site. Centre representatives have participated in collaborative activities and are very supportive of the project's efforts. It is hoped that the Centre will become more directly useful when it becomes situated.

Four of the twelve businesses contacted this year to host an on-site visit agreed to participate. The remaining eight companies contacted generally offered a good reason for their refusal, but expressed interest in involvement in the near future. This response offers encouragement for the collaborative's efforts to expand the number of businesses that eventually will be involved. It remains a challenge to the collaborative as to how best to use these resources so that teachers as well as the companies garner the greatest benefit.

PROFESSIONALISM

Many mathematics teachers in New Orleans are very much interested in improving local education. Teachers also appear to be interested in gaining new insights into teaching mathematics and into developing better ways of teaching various topics. Some aspects of the system, however, do not encourage professional development. For example, benefits are not necessarily commensurate with the costs of certification. A mathematics teacher who teaches computer science courses found the cost of taking fifteen credits to earn a certificate in computer science would exceed any benefit she would receive; such advancement would not have increased her pay benefits. Even though this teacher is interested in knowing more about computer science, she works during the summer rather than taking courses.

Although some local organizations do encourage teachers to assemble together outside of school (such as at the New Orleans Council of Teachers of Mathematics meetings three times a year, the union meetings, and department head meetings at least once a year), the collaborative's programs and leadership have made it more inviting for teachers to congregate. The number of teachers who have attended the collaborative symposia offers a solid indication of the interest of teachers and their willingness to participate in professional activities. In addition to providing the opportunity for teachers to talk with one another, the collaborative's mini-grants provide funds to allow teachers to try some creative ideas in their classrooms, and its free workshops enable teachers to learn more about such topics as discrete mathematics and the use of computers to teach mathematics.

The collaborative plans to increase the role of teachers in its decision-making process by forming a Teacher Advisory Council. This will increase teachers' involvement and allow them greater influence in developing and implementing the collaborative's activities and focus.

MATHEMATICS FOCUS

A major issue facing New Orleans teachers is a new state requirement that takes effect in 1989 that all students must have passed Algebra I and II and Geometry to graduate from high school. A concern that students do not have the prerequistes to do algebra has prompted one school to offer some ninth-grade students two mathematics classes back to back, the first in computational skills and the second in algebra.

Within the context of state requirements, New Orleans high schools differ slightly in what mathematics is offered and how the mathematics program is structured. One school, for example, has expressed interest in an integrated mathematics curriculum. In about a third of the seventeen high schools, the mathematics program includes a calculus and advanced mathematics courses. These generally are schools with some special designation, such as those with a gifted-and-talented program or a magnet program.

The collaborative's approach during its first year of operations has involved offering different activities with a variety of purposes. Thus, teachers have been offered the opportunity to attend workshops on problem solving, a symposium on applications of mathematics, and site visits to observe how mathematics is being used in industry. Many activities were designed to raise teachers' awareness levels about different uses of mathematics. The collaborative has noted that greater detail is necessary if teachers are to know more about what mathematical content is important to students today and how mathematics is being used in the workplace. One collaborative strategy has focused on forming a network of mathematics-using professionals. As the collaborative progresses, it will document the extent to which activities surpass merely providing general mathematics information to the point that teachers become more knowledgeable so that this new expertise is reflected in their teaching.

G. NEXT STEPS

The New Orleans Mathematics Collaborative as it enters its second year will continue to facilitate the cooperative efforts of mathematics professionals from the public schools, businesses, and higher education to advance mathematics education in the public secondary schools. Invitations will be extended to representatives of local corporations to encourage their active participation in the collaborative. Meetings will be held with mathematics departments in the seven local universities to increase their knowledge of the collaborative and to encourage their participation. The collaborative's overriding goal is to involve ever greater numbers of mathematics professionals from all sectors of the New Orleans community and to work toward a more permanent structure.

The collaborative will direct attention in coming months to building upon and fostering the input and ideas of teachers. A Teacher's Advisory Council will meet for the first time at the start of the 1987-88 school year. This council will provide an opportunity for mathematics teachers to discuss curricular and administrative issues, and to identify those activities for which they will assume responsibility and those that should be sent to the Steering Committee for consideration. The TAC will have a budget of $5,000 to use at its discretion.

The collaborative will work closely with the Orleans Parish Public Schools mathematics supervisor to support her work and efforts toward curriculum reform. The collaborative intends to stay informed of national curriculum reform movements and to provide opportunities for teachers to attend national meetings so that they may become more knowledgeable of current trends in mathematics education around the country.

Collaborative activities planned for 1987-88 include:

Site Visits

Forty mathematics teachers will be chosen to visit a local business to learn more about how mathematics is being used in the workplace. An effort will be made to insure that at least some teachers from each high school participate in these visits.

Some changes will be made in certain positions related to the collaborative. Sally Hayes, who in fall, 1987, took a position to head the Business Task Force for the New Orleans Chamber of Commerce, will be replaced by Constance Barkley as the Executive Director of MAC. Richard Hays, who resigned at the end of the year as Chair of the Steering Committee, will have to be replaced.

Internships

There will be no internships in the summer of 1987. Three business internships and one teaching assistantship at a university are planned for the summer of 1988 as a pilot that may be expanded in future years.

Workshops

Some workshops will be held during the 1987-88 school year. The format of these will be different from those conducted in previous years. Although the workshops during 1986-87 were not well attended, teachers expressed interest in modified versions of them. If the Louisiana Science Centre acquires permanent space, the possibility exists that the Centre will assume some responsibility for conducting workshops.

Mini-grants

In 1987-88, the MAC Education Fund will reserve $10,000 to award to mathematics-related grants for innovative classroom projects in grades 1-12. It is anticipated that a booklet outlining the mathematics grants awarded will be published in December, 1987.

Mathematics Symposia

Three symposia will be held during the 1987-88 school year, including a reception marking the one-year anniversary of the New Orleans Mathematics Collaborative. The symposia will be planned to provide an informal atmosphere in which teachers can interact with one another and with colleagues from businesses and the universities.

Newsletter

The collaborative newsletter will continue to be published and distributed to collaborative members. It is hoped that the newsletter will become a forum for the exchange of ideas and information.

SUMMARY REPORT:
PHILADELPHIA MATH SCIENCE COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the efforts of the Philadelphia Math Science Collaborative on behalf of mathematics teachers during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Philadelphia Math Science Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

PHILADELPHIA MATH SCIENCE COLLABORATIVE

A. Purpose

A primary purpose of the Philadelphia Math Science Collaborative is to promote teacher leadership and team building, and to contribute to an understanding of a vision of mathematics teaching for the future. These activities are viewed as an initial step toward the goals of promoting change and empowering teachers to make needed changes.

The specific goals of the Philadelphia Math Science Collaborative are:

1. to develop, evaluate and document the position of an in-school collaborator who would be responsible for increasing communication among teachers, including across disciplines, and for serving as a catalyst for innovation and change;
2. to increase teacher participation in extramural professional development programs which offer:
    a. partnerships between teachers and their colleagues in academia and industry;
    b. opportunities to enhance and improve knowledge, skills and professionalism; and
    c. new ideas and opportunities for mathematics instruction, including integration of mathematics and the sciences, and use of calculators and computers to teach mathematics and science; and
3. to develop a model for documenting and evaluating the impact of both the in-school mathematics collaborator's activities and teacher participation in extramural programs on the quality of teachers' professional lives, with close attention to the role of teachers as leaders and problem solvers.

B. Context

The School District of Philadelphia is a large urban district, with a total enrollment of approximately 198,000 students, 73 percent of whom are members of a racial minority. A significant number of these students come from families who live at or below the poverty level or who are otherwise socially disadvantaged.

In September, 1986, Dr. Constance E. Clayton began her fourth year as superintendent of the School District of Philadelphia. She reported that during the past three years, equal educational opportunities have been provided to all students through a balanced and focused curriculum. She also said that her administration has succeeded in balancing the district budget and in increasing the confidence that parents and financial, corporate, and educational communities have exhibited toward the schools. Dr. Clayton supports the "Focus On Instruction" as the district's major initiative for the 1986-87 school year. This initiative will provide the framework for a number of projects to improve the school district's instructional program.

A special effort to eliminate teacher shortages in special areas, including mathematics, was begun during the 1986-87 school year. Fourteen nonteaching district employees (classroom aides, secretaries, nonteaching assistants, and stock clerks) were given classroom positions after completing a professional certification program. To be eligible for this program, noninstructional employees must have a bachelor's degree from an accredited college or university; enroll in a professional certification program at their own expense; take at least two semester hours each year toward completion of certification requirements; and apply for an emergency or interim certificate.

The school district continues to use a mandated mathematics curriculum and a systemwide student-promotion program. The secondary-mathematics-course documents were revised during the 1985-86 school year and were given to teachers in the fall of 1986. Standard secondary mathematics courses are General Mathematics I and II, Algebra I and II, Geometry, Mathematics in Application, Elementary Functions, and Calculus. Marking guidelines for the promotion program recommend that final grades be based: 60 percent on teacher-made tests, 10 percent on city-wide midterm and final examinations, 15 percent on classwork, and 15 percent on homework assignments. A student should master at least 80 percent of the course objectives taught during the marking period to receive an "A" or "B." In conjunction with the new promotion policy, the school district offered summer school to freshmen, sophomores and juniors in 1986 for the first time in 17 years; prior to 1986, the summer school program was restricted to seniors. Of the 9,000 students in grades 9 through 12 who attended summer school, two-thirds were promoted because of successful course completion. Thus, as standards increase in the three-year phase-in of the systemwide promotion program, summer school has contributed to student success in such a way that the retention rate has remained constant.

The Secondary School Mathematics Curriculum Committee (SSMCC) plays a major role in specifying the mathematics curriculum in Philadelphia. The committee meets four times each year, although its working subcommittees meet more frequently; it is comprised of administrators, instructional leaders, mathematics teachers and mathematics educators concerned with the mathematics programs in grades 7-12 in the School District of Philadelphia. The committee reviews programmatic conditions and makes recommendations concerning program generation or program modifications (i.e., content, objectives, instructional support, articulation between or among courses/program, and document format). It is in this manner that local district curriculum is shaped.

A wide array of programs is available to teachers in Philadelphia. They include those sponsored by the Philadelphia Renaissance in Science and Mathematics (PRISM), The Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV), and several area colleges and universities. In addition, the Division of Mathematics of the School District of Philadelphia sponsors a number of activities and coordinates activities developed by others. Mathematics teachers, however, have not always taken advantage of these opportunities.

C. Development of the Collaborative

The collaborative was originally established in February, 1985, under the name Philadelphia Mathematics Collaborative (PMC). During the 1985-86 school year, it became clear that the PMC's two main problems were hampering the growth of the collaborative. The first was conceptual: On what basis could the collaborative establish a program of activities within the context of the rich array of opportunities already available to mathematics teachers in Philadelphia? Many of the activities initiated by the urban mathematics collaboratives in other cities already were available to Philadelphia teachers through other organizations. The second problem was managerial. The collaborative needed a coordinator with the energy and the vision to establish a reasonable program of activities. Furthermore, since The Franklin Institute is strong in science rather than in mathematics, conceptual help with respect to mathematics also was needed. However, budget constraints and the Institute's salary schedule prohibited hiring a project coordinator who would have all the necessary qualifications.

In order to address these problems, it was agreed with the Ford Foundation that the project should be restructured: (1) the collaborative would focus its efforts on a targeted number of schools; (2) the proposal for continued funding would address ways that the collaborative would relate to the other activities already available in Philadelphia; and, to coincide with the emphases of PRISM, (3) the collaborative would encompass science as well as mathematics. In fall, 1986, the Philadelphia Mathematics Collaborative was renamed the Philadelphia Math Science Collaborative. Dr. Wayne Ransom continued as the director of the restructured math/science collaborative.

Ms. Sue Stetzer assumed the coordinator's position on October 1, 1986. An experienced mathematics teacher and department head in the Philadelphia district, Ms. Stetzer is well known to teachers and administrators. She has been active in ATMOPAV and in the collaborative. Until her appointment as coordinator, Ms. Stetzer was the on-site observer of the collaborative for the UMC Documentation Project; that position was then filled by Ms. Joyce Neff, a high school mathematics teacher in the Philadelphia schools.

The collaborative now sits within the PRISM structure. PRISM is itself a component of the Committee to Support Philadelphia Public Schools (CSPPS). The Philadelphia Alliance for Teaching Humanities in the Schools (PATHS), also a component of CSPPS, works with PRISM in administering some programs.

The collaborative's Advisory Council was formed in fall, 1986, replacing the Administrative Coordinating Committee that had existed during the first year of the collaborative project. The Advisory Council is comprised of six teachers representing the six target schools, the directors of Mathematics and of Science representing the school district, Dr. Francis Betts and Elizabeth Haslam of PRISM, Joyce Neff representing ATMOPAV, Dr. Alex Tobin representing the Philadelphia Regional Introduction for Minorities to Engineering (PRIME) program, and representatives of the Philadelphia Secondary Science Association, Drexel University, the Society for Industrial and Applied Mathematics (SIAM), Philadelphia Community College, PECO (the Philadelphia Electric Company), Sun Oil, and Philadelphia Federation of Teachers. The council's purpose is to provide support to the coordinator and direction for the collaborative by helping to evaluate and reshape existing programs, as well as by designing new programs. The council is scheduled to meet bimonthly during after-school hours.

The council met five times during the 1986-87 school year. At the first of those meetings on October 28, Sue Stetzer reviewed the history and purpose of the collaborative. Wayne Ransom described the council's role as one of helping to identify opportunities for teachers and providing direction for the collaborative. The council discussed existing programs and their relationships to the collaborative. Members in attendance felt the meeting was worthwhile and appreciated the diversity of the group. A few participants expressed a "wait-and-see-what-develops" attitude, while others began to identify people who should also be involved. This first meeting resulted in the name change to PMSC.

Following the first meeting, the Advisory Council membership was expanded to include the school district's director of Computer Science Technology, as well as additional representatives from Temple University, the College of Textiles and Science, and the University of Pennsylvania. This brought the total Council membership to twenty-four.

The second meeting of the Advisory Council was held December 17 at The Franklin Institute. Eighteen people attended. The agenda included a report on collaborative activities and a lengthy discussion of the Professional Enrichment Grants (PEGs).

These grants are available to high school mathematics and science teachers to attend professional conferences and workshops. It was decided to include both professionally active teachers and those who have yet to be introduced to conference participation. Frank Betts of PRISM offered up to $1,200 to match the collaborative's funds for grants to teachers in nontargeted schools. The meeting was productive and participants appreciated that everyone was allowed to participate in the discussion. Because the meeting went so well, everyone was very encouraged about the future of the collaborative.

During the meetings in February, April, and June, 1987, the Advisory Council sought to define its role more clearly and to identify ways in which each member might contribute resources to the collaborative. Problems associated with identifying and securing resources from colleges and universities, and from the business and corporate communities became a dominant theme. At the February meeting, coordinator Sue Stetzer distributed and discussed a list of proposed goals for the future. At the April meeting, Mark Driscoll of the UMC Technical Assistance Project spoke to the council about the resources available to the Philadelphia collaborative through the Technical Assistance Project. Dr. Driscoll also discussed ways in which the UMC collaboratives nationwide are growing and helping teachers to network and access resources. The issue of achieving increased participation among teachers was addressed as well.

A move is currently underway to redefine the membership and structure of the collaborative's Advisory Council. Two issues have prompted this change. One problem involves a collaborative policy that a representative from each of the target schools should serve on the council. The projected increase in participating schools would make membership unwieldy and unbalanced within the present structure. A second concern is that strategies are being sought to increase the Advisory Board's participation in policy formation for the collaborative. One committee structure that would address both problems would include a twelve-member steering committee, which would be aided by a program planning committee and a communications committee. These subcommittees would each meet bimonthly, on alternate months, to provide direction and to address issues of linkages with other initiatives both within and outside PRISM. The program committee would identify those activities that were appropriate, as well as resources available to the collaborative and its members. The communications committee would concern itself with the transfer of information and ideas within and between school buildings, and to the community at large.

The Philadelphia Math Science Collaborative has focused on six secondary schools. The decision to limit the project to six high schools was based on a desire to establish an identity in the face of the many other activities already available to teachers in the Philadelphia area. A collaborative involving all schools would be viewed as identical to many other such projects; a collaborative that initially involves only six schools does not experience pressure to develop large-scale activities, but can work on a small scale to develop strategies to get teachers involved in programs already available. Restricting the initial efforts of the collaborative to six schools thus facilitates project management and makes it easier to identify schools that are committed to the collaborative concept.

On June 16, 1986, the collaborative invited principals and science and mathematics department heads from the six target schools to a recruitment meeting. The schools, chosen by David Williams, Director of the Division of Mathematics for the School District of Philadelphia, represented typical inner-city schools. These particular schools were selected because their mathematics department heads had already participated in some PRISM-sponsored programs. Also in attendance were Dr. Williams; Dr. Francis Betts III, the executive director of PRISM; Don Steinberg, the director of the Division of Science for the School District of Philadelphia; Wayne Ransom, the director of education programs for The Franklin Institute and of the Philadelphia Math Science Collaborative project; and Sue Stetzer, who was to become coordinator of the Philadelphia Math Science Collaborative.

At the meeting, Ms. Stetzer outlined the goals of the collaborative and the services the Philadelphia Math Science Collaborative expected to offer to participating schools. These services included: professional consultations and secretarial help in the preparation of PRISM minigrants; facilitation of exploration of curricular areas of common concern in joint mathematics-science department meetings; help in identifying and obtaining speakers from the business, industry, and academic communities; and support for teachers in areas in which they identify specific professional needs. In exchange for these services, each participating school was asked to agree: to hold a minimum number of joint math-science department meetings during the 1986-87 school year; to provide access for the collaborative coordinator to attend department meetings and to meet with mathematics and/or science teachers individually or in groups; and to support the goals of the collaborative.

The general response at the meeting was favorable. The mathematics department heads knew Sue Stetzer well and were generally receptive. The science department heads, on the other hand, tended to be somewhat skeptical. At the meeting, a letter of agreement was distributed, and the principals and department heads were asked to return a signed copy by June 26 indicating their willingness to participate. All letters of agreement were returned.

The six target schools for the Philadelphia Math Science Collaborative and each school's student enrollment are: Murrell Dobbins Vocational-Technical (1,993); Martin Luther King (2,041); Overbrook (2,283); Roxborough (1,333); Thomas Edison (1,667); and West Philadelphia (1,640). All are inner-city schools. The student population at four of the schools is nearly all black. At

Roxborough, 50 percent of the students are black, and 48 percent of the students are white. At Edison, 37 percent of the students are black, 59 percent of the students are Hispanic, and 3 percent of the students are white. Of the students who graduate from these six schools, 30 to 40 percent plan to go on to some form of higher education, 5 to 10 percent plan to go into the military, and 5 to 40 percent plan to work. On average, about one-third of the teachers at each high school are black, and two-thirds are white. Two of the high schools have Hispanic teachers. The number of mathematics teachers at each school ranges from ten to fifteen; the number of science teachers ranges from six to fifteen.

Four of six target schools operate on an abbreviated daily schedule. Consequently, there is no lunch period, and school is dismissed at 1:18 p.m. This type of schedule increases teachers' isolation both by making brown-bag lunch seminars impossible and by reducing the probability of these teachers participating in after-school programs (which usually start at 4 p.m.).

Procedures for selecting three more schools were discussed at an April meeting of the Advisory Council. There had been a belief initially that magnet schools should be excluded, as they served an elite class of students and were relatively well serviced. The district directors of mathematics, Dr. Williams, and science, Mr. Steinberg, argued against this view on the grounds that these schools tend to have a more senior staff who had been away from training for many years, and who needed the stimulation that involvement could provide. Further, in excess of 60 percent of students in these schools were from minority groups. In response to these concerns of the district directors, magnet schools were considered for inclusion.

The twelve department heads from the original six target schools attended a luncheon meeting in May, 1987. This meeting also focused on the appropriateness of a range of criteria for selection of new target schools.

In identifying the next schools to join the collaborative, the attitude of the principals, the level of commitment by mathematics and science teachers, and, implicitly, the capacity of the departments to create access that facilitates interaction between department heads and teachers and the project coordinator, were taken into account.

The project coordinator views as important a perception among teachers that the collaborative complements and supports the efforts of the district's mathematics and science directors. The importance of the directors' influence on collaborative processes should be seen in this light, as should the planning of activities such as the workshops offered by the project.

D. Relationship with Other Local Initiatives

Several key organizations in Philadelphia sponsor activities that have a direct bearing on the support of mathematics and science teachers in the city and, therefore, impact directly on the activities of the collaborative. They include The Franklin Institute (the funding agency), CSPPS, PRISM, PRIME, and ATMOPAV.

The Franklin Institute has a 150-year history of promoting science and technology. As the region's only science and technology center, the Institute has valuable expertise to apply to the improvement of science and mathematics education. It has been a pioneer in the area of experimental education, including hands-on exhibits, resource materials and kits, and it has conducted seminal work in evaluating the effectiveness of exhibits and other informal teaching media. The Franklin Institute has a strong tradition of cooperative relationships with other organizations in the private and public sectors and has been deeply involved in new initiatives in mathematics and science teacher training.

The Committee to Support Philadelphia Public Schools (CSPPS) was started more than three years ago as an organization comprised of high-level corporate, higher education, and foundation executives. The CSPPS has approximately $2.5 million available to support teaching programs; the committee established a humanities task force, and initiated PRISM.

PRISM is an alliance of educational and cultural institutions, governmental agencies, corporations, the Philadelphia Federation of Teachers, and the School District of Philadelphia. PRISM's purposes involve stimulating interest in science and mathematics education, assisting teachers in increasing the effectiveness of their instruction in science and mathematics, and supporting the efforts of the school district to increase enrollment in these areas. PRISM's activities are primarily developmental in character, intended to increase resources available for instruction in mathematics and science through the creation of programs that have the potential to become financially independent. A limited professional staff consults on program design and financing and monitors quality control in PRISM-supported programs. PRISM neither solicits funding from the public nor provides total funding for any single program. Programs supported by PRISM, in addition to the collaborative, include the Teachers Advisory Group, PRISM Institute, the PRISM minigrants (jointly administered by PATHS), PRIME, the Math/Science Clearinghouse, PTIP (Philadelphia Teacher in Industry Program), and PRISM Colloquia.

PRISM was relatively new when the Philadelphia Math Science Collaborative was formed. Since then, PRISM has been reorganized in order to coordinate a broad range of activities. The organization became more structured in February, 1986, with the appointment of Dr. Francis M. Betts as executive director. With the announcement that Dr. Betts will be leaving in July, 1987, to assume a superintendent's position in Colorado, the future structure of PRISM is not as certain as it might otherwise have been. Any PRISM restructuring may affect the financial and managerial arrangements of the collaborative.

In April, 1986, PRISM formed a Teachers Advisory Group (TAG). Teachers are appointed to the group through nomination by the school district, the Philadelphia Federation of Teachers, and area professional associations of teachers in science and mathematics. The group serves as an advisory body to PRISM in planning new programs, evaluating ongoing programs, and communicating with practitioners in the field. Each TAG member will work closely with one PRISM project in both an advisory and leadership capacity, thereby joining with representatives of the school district, cultural and educational institutions and corporations on program advisory boards.

PRIME was established in 1972 at the initiative of General Electric; it is a program of PRISM. PRIME has actively supported improvements in school mathematics and has expanded its interest from engineering to other areas such as pharmacology and actuarial work. PRIME consists of thirty-two businesses, seven colleges, nine environmental organizations and two school districts, Philadelphia and Camden. Two thousand children participate in its programs, with 450 enrolled in summer programs. PRIME focused on two initial goals. The first was to garner commitments from the district regarding staff development for higher levels of mathematics. The second was to combine informal programs through The Franklin Institute and other agencies with formal programs and professional societies to improve what was considered to be poor communications between the colleges and schools. It was believed that PRIME could act as a catalyst because of its independence from other groups and organizations.

The Association of Teachers of Mathematics of Philadelphia and Vicinity (ATMOPAV) has an active membership of approximately 850 high school and college mathematics teachers. It provides regular programs and a newsletter.

Six institutions of higher education in the Philadelphia area have offered cost-free course auditing during the 1986-87 school year to Philadelphia public school teachers involved in PRISM programs. The courses are offered to enable teachers to strengthen their professional growth in science, mathematics and the humanities. The sponsoring institutions are the University of Pennsylvania, Community College of Philadelphia, Villanova University, Bryn Mawr College, Beaver College and Chestnut Hill College.

E. Project Activities

During the 1986-87 school year, the Philadelphia Math Science Collaborative sponsored a variety of activities and programs designed to promote teacher leadership and team building among teachers in the six target schools. They are described in the section "Collaborative Sponsored Activities."

Another goal of the collaborative is to increase teacher participation in the many professional-development programs offered in the Philadelphia area; during the 1986-87 school year, a wide array of such programs and activities were available to secondary mathematics teachers. The majority of these events were planned by CSPPS, PRISM, The Franklin Institute, the Division of Mathematics of the School District of Philadelphia, and ATMOPAV. The collaborative supported these related activities by publicizing the events, encouraging teachers to attend, and, in a few cases, providing some funds to contribute to the event or to allow teachers to attend. These activities are described in the "Collaborative Supported Activities" section.

Early in the 1986-87 school year, Coordinator Sue Stetzer met with each of the mathematics and science departments at the target schools during their regularly scheduled meetings. She outlined the goals of the collaborative and discussed the services it could offer. Each school expressed different needs so that the in-school component of the collaborative's activities took shape in six different ways, resulting in a wide range of activities within the target schools. These activities are described in the section "Target School Activities."

COLLABORATIVE SPONSORED ACTIVITIES

"Meet the Directors" Meeting

On December 3, 1986, a wine-and-cheese reception was held to enable mathematics and science teachers in the district to meet the school district's director of mathematics and director of science. Forty teachers, including six from the target schools, attended the event at The Franklin Institute. The meeting was viewed as a success; teachers enjoyed getting together with one another as much as meeting the directors. Dr. David Williams, the Director of Mathematics Education, was so pleased that he suggested such a gathering be held monthly.

Target School Luncheon

On March 14, 1987, the collaborative sponsored a luncheon for mathematics teachers from the target schools and representatives of the district's mathematics departments in conjunction with the Mathematics Leadership Conference at Host Farms in Lancaster. The luncheon provided an opportunity for teachers and administrators to meet, socialize, and discuss common concerns. One teacher commented, "It was delightful, useful. It was a nice setting at a professional level. We voiced some concerns about PRISM grants or irritations with funding." Another said, "It gave me a chance to speak to people at different schools. I met some former classmates and we exchanged ideas." A third lamented, "It is pathetic the cages we are in in our own little rooms. It is so rare to talk to another adult in a nice setting. Teachers are so burdened that it is like we are on an assembly line and there is no time to talk."

The on-site observer noted that "a wonderful feeling came out of this luncheon. Teachers felt they were part of something special."

Luncheon Meeting

On May 6, 1987 the Philadelphia Math/Science Collaborative sponsored a luncheon to discuss and evaluate the collaborative with science and math department heads, directors, and teachers from the six target schools.

One teacher commented, "This was nice, really nice for everyone to get together and talk about common concerns--also to hear other perceptions. There were some differences of opinion. It is good to be able to collaborate. The bottom line is putting material in teachers' hands." Another stated, "It was very nice. It is nice to be given the opportunity to tell about the strengths and weaknesses. It was good to talk to each other because we don't often have that opportunity. It was nice to learn what is happening in other schools." The on-site observer noted: "I think the discussions were positive--they were certainly active (and noisy). The most important aspect that came out clearly was that math and science departments need to talk to each other, to find out each others' needs."

As part of PRISM's documentation project, surveys were distributed to the department heads and teachers who attended, asking them to report on the changes they had observed as a result of the collaborative, what they valued most about the collaborative, the problems they identified that should be addressed by the collaborative, and their suggestions for the coming year. The answers indicated that there has been a rise in involvement in professional organizations, workshops, conferences, and other professional activities, increased awareness of grant opportunities and increased access to materials. The teachers valued highly the opportunity to share ideas with other teachers, the monthly newsletter, the professional opportunities, and in general, "the fact that someone out there cares." Teachers identified such needs as increased communication between mathematics and science departments and help in increasing meaningful computer use among teachers and students. Problems of student motivation also were mentioned. Suggestions for next steps included in-school networking; in-service training on computers, leadership, and motivation; and a focus on the problems that "students face daily."

Mathematics Department Heads' Annual Luncheon

On May 21, 1987, the mathematics department heads' end-of-year luncheon meeting was held at Roxborough High School, paid for by the collaborative. Twenty-eight department heads, and the Director and Assistant Director of Mathematics Education heard two teachers report on the PRISM grants they had received.

One teacher commented, "I enjoyed it; it enhanced our professionalism and showed us an example of special education students learning a useful trade while at the same time providing a social opportunity for teachers to exchange ideas and good wishes." Another said, "I loved it. I enjoyed the opportunity for collegial interactions relative to specific uses of the computer, because it gave me the opportunity to know that other people were having the same problems that I was having."

The Assistant Director of Mathematics Education said, "It was lovely--one of the most beneficial meetings. It opened discussions of things we have not explored. It is a beginning of new directions for us and renewed commitment to get this task moving."

Geometric Supposer Workshop

On April 24, 1987, the collaborative sponsored a workshop on the Geometric Supposer at the Regional Computing Resource Center, Philadelphia College of Textiles and Science. A representative from the Sunburst Communications Company presented the session. Thirty-one high school teachers, supervisors of math, and key math personnel attended.

One teacher commented, "It was good, very nice. We could explore on our own and see how our students could explore. I learned that relationships are important while computation is less important. It would have taken at least a class period to do what we did in less than 1/2 hour. We are all held back in geometry because of computation." A second teacher said, "Having people with similar interests working together, sharing ideas and socializing is valuable." Another said, "I enjoyed the opportunity to work with my colleagues on an intelligent, intellectual level."

As a result of this introduction to the Supposer, teachers from four schools expressed interest in joining a network of Geometric Supposer users across the country. This network will be coordinated with EDC, and will allow teachers to use the telecommunications equipment already in their schools to share feedback on their use of the Supposer. The on-site observer noted, "there was a great deal of interest in the software and the added possibility of networking created a lot of interest."

Dues to Professional Organizations

In the 1985-86 school year, the Philadelphia Mathematics Collaborative paid the ATMOPAV membership fee for every Philadelphia public high school mathematics teacher, increasing the organization's membership by about 250. During the 1986-87 school year, the collaborative paid the ATMOPAV membership fee for all the mathematics teachers in the six target high schools. The collaborative also pays the membership fee to the Philadelphia Secondary Science Teachers Association for the science teachers in those six schools. In 1987-88, the collaborative intends to pay half of the fee for those teachers in the 1986-87 target schools, and all of the fees for those in the three new target schools.

Philadelphia Math Science Collaborative Newsletter

Sue Stetzer, coordinator of the Philadelphia Math Science Collaborative, edits a monthly newsletter that is sent to the mathematics and science teachers in the six target schools. Copies of the newsletter also are sent to the principals, and to mathematics and science department heads in all high schools in the district. Sue Stetzer delivers copies of the newsletter to the target schools, taking the opportunity to visit with teachers.

The first issue of the newsletter, published in November, 1986, described the collaborative and PRISM. The newsletter explained that the collaborative was trying to determine what can be done to make the teacher's job easier. Programs designed to reduce teachers' isolation and to increase collaboration with their peers in the business, industrial, and academic communities were listed. The newsletter also included a calendar of relevant events in November and a questionnaire seeking feedback about what teachers would like to see the collaborative doing. Responses to the questionnaire included "desire for involvement with industries," "reduce work load by not having to write school plans," and "open communications between mathematics and science teachers."

The newsletter was published eight times between November, 1986, and June, 1987. It reported in December on the collaborative's change of name from the Philadelphia Mathematics Collaborative to the Philadelphia Math Science Collaborative. The newsletter also provides a calendar of events that may be of interest to mathematics and science teachers, reports on upcoming activities (whether organized by the collaborative or not), and provides a forum for the exchange of items of concern to its readers.

Mathematics in Applications Networks

In fall, 1986, the collaborative initiated plans to establish a teachers' network in Mathematics in Applications, a new third-year nonacademic mathematics course. This network will attempt to distribute public-domain software and teacher-written templates to be used with Appleworks and the Graphics Department. Teachers will act as the primary source of materials for the network. An article in the December issue of the collaborative newsletter requested teachers to submit to Sue Stetzer ideas, software they have developed, or activity plans they have prepared. In early 1987, eighty-five copies of software and an accompanying twenty-page booklet describing teacher activities were distributed to mathematics department heads and to all teachers of the course Mathematics in Applications. In addition to the materials, ACCESS, a newsletter that lists resources and sample activities, was circulated. Three issues were distributed.

Clearinghouse

Related to the establishment of the Mathematics in Applications Network, the PMSC also provides a clearinghouse service to teachers in its target schools by keeping these teachers notified of resources for classroom use. In the December issue of the PMSC newsletter, teachers were informed of two video cassettes they can get free of charge from a project sponsored by Phillips Petroleum Company. The two video cassettes include seven programs about mathematics and problem solving. Another resource available was the loan of energy-related computer software, compatible with the Apple IIe, from the Philadelphia Electric Company.

COLLABORATIVE SUPPORTED ACTIVITIES

1986 Summer Institutes

During the summer of 1986, PRISM sponsored three Summer Institutes for Philadelphia mathematics teachers. Each Institute combined theory (often taught by a college faculty member) and classroom applications (taught by a Philadelphia school district administrator). The participants received a modest stipend and an allowance to cover the cost of books, materials, and tuition. Each participant earned six graduate credit hours. Although the PMSC was not in a position to support the Institutes actively, the events were the successors to the 1985 Summer Institutes, which were supported by the original collaborative. In fact, one of the Institutes was consciously designed as a follow-up for teachers involved in the previous summer's activities.

Eighteen teachers participated in the first of the three Institutes, which was held at Chestnut Hill College. The two graduate-level courses taught were "Topics in Calculus" and "Methods and Technology in Teaching Calculus."

The second Institute was held at Drexel University. Seventeen teachers took the three courses offered: "Introduction to Analysis," "Special Topics in Mathematics," and "Special Topics in Computer Sciences." (This Institute was very similar to the 1985 Institute that had been cosponsored by the collaborative.)

PRISM's final 1986 Summer Institute, also held at Drexel, was an intensive two-week workshop on computer applications. Fifty-nine teachers from the nine high schools that had been awarded the Ben Franklin grants participated in the program. The School District of Philadelphia loaned each participant a computer for home use during the summer. PRISM equipped the computers with telephone modems to enable the teachers to connect to PRISM's electronic bulletin board, "High Tech Talk." The workshop proved to be the first telecommunications experience for many of the teachers. Teachers from four of the six target schools participated.

All three Institutes appeared to be very successful. Dr. David Williams, Director of Mathematics Education, observed: "This is a stimulating, rigorous experience for teachers; they work very hard, enjoy it, while improving themselves professionally." The Director of PRISM, Dr. Francis Betts, said, "PRISM Summer Institutes enable teachers to learn both up-to-date information in math and computers and also how to apply this to the classroom. And the camaraderie and creativity generated by the Institutes translates directly into renewed enthusiasm when the teachers return to their classrooms in the fall."

PRISM Curriculum Forums

The collaborative publicized in its newsletter, through ACCESS, and in the coordinator's school visits four Curriculum Forums PRISM offered on March 5, March 25, April 1, and April 23 at the University of Pennsylvania Faculty Club and Temple University Faculty Club. The Forums were designed to give teachers an opportunity to voice their concerns about curriculum. The teachers were promised that David Williams, Director of Mathematics Education, would address their concerns and possibly make changes reflecting their input. Each meeting was held after school, and twenty-five to thirty K-12 mathematics teachers attended. At each session, teachers met in groups of eight to ten to discuss particular curriculum issues. A group leader summarized the results of the discussion and the recommendations of the group at a PRISM-sponsored dinner following each session. Leaders also sent reports to the district's Division of Mathematics Education. Each leader received a $50 stipend for their efforts.

The Curriculum Forum Series was enthusiastically received, perhaps due in part to the willingness of the school district's Mathematics Division to listen to the teachers' suggestions. Some group reports were used immediately in the district's review of the curricula for grades 7 and 8. Teachers' comments reflect their appreciation. One teacher said, "I am glad I participated in this. People needed more direction and were interested in learning techniques. The collegial sharing was wonderful. Most people in my group enjoyed participating and want to continue. We shall meet again to continue our discussion." Another stated, "Interested teachers could discuss curriculum with no time constraints and the people downtown will answer our complaints." Many teachers' groups established at the Forum have continued to meet on their own to discuss curriculum issues.

Science and Math Teachers' Workshop

On February 26, 1987, a workshop for science and math teachers, sponsored by the Philadelphia Electric Company (PECO), was held at the Sheraton Hotel, Valley Forge. The program included dinner and a panel on "Guiding Students to Careers of the Future." The collaborative promoted the workshop through its newsletter and during school visits. One teacher commented, "I found it interesting to get information concerning the current state of engineering education and jobs. It could have been better publicized and attended by math people." Another stated, "The speakers were personable and related to the audience. The program was well planned. I would like to have included strategies for attracting minority students in the inner city high schools."

Programs for Teaching

On February 28, 1987, a Philadelphia Federation of Teachers annual conference entitled "Programs for Teaching" was held at the Wyndham Franklin Plaza Hotel and Friends Select School. Thirty-two members of the Philadelphia Federation of Teachers attended a workshop presented by the collaborative's coordinator Sue Stetzer, Shelly Berman, and Leslie Cavanagh. The program, entitled "Solving the Problems of Teaching," was one of many from which participants were able to choose. It focused on the implementation of PRISM grants in recipients' schools.

All teachers interviewed said the activity was worthwhile. Comments included: "I liked it a lot. It gave the people what they came for. It gave ideas regarding grants. It was helpful and at the same time, we were able to pick up good teaching strategies." Another appreciated "being able to be in contact with the recipients of mini-grants and discuss grants, materials available and applications," but didn't like the fact that "they focused on the content rather than the process and development of a grant."

Salute to Teachers

A reception celebrating National Science and Technology Week and Mathematics Education Month was held at The Franklin Institute on April 6, 1987. Financial support for the event came from ATMOPAV, PRISM, PSST, and The Franklin Institute, as well as from the collaborative. Sue Stetzer was instrumental in obtaining the funding from ATMOPAV, as well as in the distribution of invitations. Approximately 200 Philadelphia K-12 math and science teachers attended.

One teacher commented, "It was well attended. It was well done. I thought the math displays were good. I played with the puzzles. I got good ideas from the presentations. However, more was available for elementary schools. I'd like to see more for senior high--more math for my computer class." Another teacher stated, "I really thought it was nice. There was a good combination of high school and elementary school presentations. Unfortunately, math was sent upstairs." The on-site observer felt that "the math presentations were an afterthought. It seemed to be geared toward science teachers."

Demonstration of Corvus Computer

A demonstration of Corvus-driven computer networking was held on April 27 at Martin Luther King High School. The meeting was organized by the department head, who was interested in setting up a computer network within the school. Eighteen department heads and other administrators at the high school, as well as collaborative coordinator Sue Stetzer, attended the meeting. This activity demonstrates the leadership and initiative that department heads in the six target schools have begun to assume.

Lego Logo Demonstration

On June 25, 1987, a demonstration of Lego Logo products was held in conjunction with a Seymour Papert press party at The Franklin Institute. The collaborative supplied a guest list for the event; thirty teachers and school officials were invited to attend. Seymour Papert spoke to the gathering.

One teacher commented, "The best part of something like this is the collegiality--talking with people on your own professional level. I think tonight is important because Logo empowers people. That is what these toys do--empower people. This is what we should be looking for. It gives the teachers and kids the ability to approach problems and come up with something to do with them. What I try to do myself is to come up with mental toys." Another said, "First of all the concept of Lego Logo is very exciting educationally. Fabulous! The fact that in research they found out that girls are not intimidated. They jump right in and got involved. When they got closer to adolescence, they shied away from it. That gives me a hope. This gathering is wonderful. It is so easy to exchange ideas and reestablish old contacts. We need this--especially after a tough year. It really is a recharger."

Appleworks Staff Development Workshop

During the 1985-86 school year, the School District of Philadelphia and Sun Oil sponsored a five-week training program in the use of the Appleworks software package. On-site training by Sun Company personnel was offered after school one day each week to twenty to thirty teachers from each of five senior high schools during the months of April and May. In fall, 1986, a five-week training program in the use of the Appleworks Software package was offered several times. In addition to personnel from the Sun Company, employees of Smith Kline & Beckman, Cigna, and Mellon Bank participated. During 1986, such training was offered to teachers in twenty-eight senior high schools, including the collaborative's target schools.

High Tech Talk (HTT)

High Tech Talk, PRISM's electronic mail bulletin board and teleconferencing system, was tested in early 1986 and came on-line 24 hours a day in May. The system operates out of the PRISM office in the United Engineers Building. HTT is viewed as a means of linking educators with their industrial counterparts through a rapid, convenient, and inexpensive means of communication. The system is available to all Philadelphia mathematics and science teachers. PRISM will aggregate teachers' individual orders for modems and communication software in order that teachers can benefit from a bulk discount purchase price. In the summer of 1986, PRISM acquired fifty modems for distribution to teachers participating in the PRISM Summer Institute on Computer Applications in Teaching. In the fall, the modems and software were redistributed to math and science departments for use in instructional support.

High Tech Talk provides a variety of services to science and mathematics teachers. The main menu lists the following submenus: Administration; Bulletin Boards; Clearinghouse--PRISM's Information Center; List of HTT Members; Electronic Mail; The Problem Solver's Corner; University and College Information; and Special Interest Groups. Among the information included under "Bulletin Boards" are activities of professional societies, public domain software, and Swap Shop. "Clearinghouse" includes the complete Philadelphia Math/Science Resource Catalog (which lists twenty-one field-trip sites dealing with science and mathematics), plus a calendar of professional programs. The Electronic Mail Section allows users to leave messages for one another, including pages of text. The Problem Solver's Corner encourages professional level communication on scientific, technical and pedagogic issues. The Philadelphia Math Science Collaborative hopes to encourage ongoing communication between the target schools through High Tech Talk and has, therefore, established its own bulletin board on the system. It is anticipated that the teachers will use it to share ideas and objectives.

Currently, more than 100 teachers are using HTT, including some from the collaborative's target schools. Those teachers who participated in the Summer Institute appear to be the most active users.

ATMOPAV Meetings

The collaborative pays ATMOPAV's annual membership fees for teachers in the target schools, and publicizes its activities in the newsletter.

Fall Meeting. The ATMOPAV Fall Meeting was held Saturday, October 25, 1986, at the Philadelphia College of Textiles and Science; the meeting's theme was "Mathematics: Today and Tomorrow." As part of the day-long meeting, the collaborative cosponsored a luncheon and issued invitations to teachers from the target schools.

Teachers from the collaborative who attended appreciated the speakers but were somewhat overwhelmed by the number of concurrent sessions. Ninety people attended the luncheon, including members of the collaborative, speakers, members of the ATMOPAV board, and past presidents of ATMOPAV. This was a good opportunity for the teachers to socialize with one another and to exchange ideas.

Winter Meeting. The ATMOPAV Winter Meeting was held Saturday, January 24, 1987, at Beaver College. The theme was: "Serious Enjoyment through ATMOPAV of Numbers Creatively Encountered." The collaborative cosponsored a luncheon associated with the meeting, and invited target school teachers.

Spring Meeting. The ATMOPAV Spring Banquet was held May 7, 1987, at Williamson's Restaurant in Horsham, PA. Approximately 105 persons, seventy from ATMOPAV and thirty-five from the Bucks County Council of Teachers of Math, heard Joel Schneider of Square One TV speak about the Square One television program. The collaborative paid half of the speaker's fee. One teacher stated, "The thing that amazed me was how many secondary teachers were unaware of Square One. It forced people to view at least one segment and evaluate it. It was a good opportunity to get local organizations together. It was better to have just a banquet than a workshop and dinner." Another said, "I thought it went well. More people were involved and attended than we had in the last few years. It was nice sharing the work. I enjoyed the speaker. I was so excited to go just to hear him."

The on-site observer noted, "This was the first time Bucks County and Philadelphia shared a program; it worked out well."

Available Newsletters

A variety of newsletters were distributed during the 1986-87 school year to the secondary school mathematics teachers of the School District of Philadelphia. Among these were: "Continuum," a newsletter published jointly by PATHS and PRISM six times each year, includes information about the Philadelphia Math Science Collaborative; "Communique," published by the CSPPS; "PSST Newsletter" published by the Philadelphia Secondary Science Teachers; the "ATMOPAV Newsletter;" and the newsletter published by the School District of Philadelphia. The ATMOPAV Newsletter, which is published three times each year, also promotes activities for and provides information about the Philadelphia Math Science Collaborative. Sue Stetzer, the coordinator of the collaborative project, is also the editor of the ATMOPAV Newsletter. In addition, the collaborative publishes its own newsletter.

Minigrants: Conferences and Conventions

The collaborative provides Professional Enrichment Grants (PEGs) to high school mathematics and science teachers in the Philadelphia public schools to enable them to attend professional meetings, workshops, and seminars. Through the PEG program, nine teachers from target schools and twelve from nontarget schools attended mathematics and science conferences across the country.

The collaborative had $4,800 to offer to teachers from the target schools, plus an additional $1,200 earmarked for teachers in nontarget schools. In addition, PRISM has offered to match the $1,200 stipend to nontarget schools, and the Technical Assistance Project of the Urban Mathematics Collaborative provided $600 to allow some teachers to attend the National Educational Computing Conference; this money was used in lieu of sending a teacher to the TAP-sponsored Exeter activity.

Grants are to focus on a general area of professional development. The collaborative budgeted $400 for each department within each school; individual grants were not to exceed $250. Interested teachers submitted an application form to Sue Stetzer at least thirty days prior to the event or meeting for which funding was requested. Teachers from the six target schools were given priority.

Mathematics Leadership Conference. The second annual Mathematics Leadership Conference, sponsored by the School District of Philadelphia, was held March 13-15, 1987, at Host Farms in Lancaster. Approximately 253 math teachers from the school district of Philadelphia and a number of parochial teachers who came as guests attended. The collaborative provided funds through the PEG program for eight teachers to attend this meeting.

The conference was well received. One teacher commented, "It allows teachers to communicate about school related matters in a nonthreatening manner. Fosters new friendships." Another said, "There was a good selection of presenters who were actually teachers instead of the professor types. It is better to hear from teachers who do the same as we do all the time." The Director of Math Education stated, "It was a wonderful experience. I was impressed with the warmth, camaraderie and caring that was seen here this weekend."

It should be noted that the Mathematics Leadership Conference, with eight target school teachers attending, accounted for the entire mathematics grant money of four of the six target schools.

Philadelphia Council of Teachers of Mathematics (PCTM) Annual Meeting. Twelve collaborative teachers, including two teachers from the Philadelphia school district who had received PEG grants, attended the PCTM annual meeting on March 20, 1987, in Harrisburg, Pennsylvania. Sue Stetzer and Diane Briars of the Pittsburgh collaborative gave a joint presentation about their respective collaborative. The teachers enjoyed the conference and the networking that occurred. One teacher commented, "I enjoyed attending the meetings. It gave me a chance to see what was working in other schools. It was a good meeting." A second said, "It was a wonderful opportunity to get away from the pressures of school and to network. Too bad more teachers did not have the same opportunity."

NCTM Annual Meeting. Five collaborative teachers received financial support to attend the NCTM Annual Meeting held April 8-10, 1987, in Anaheim, California. Comments from those five teachers emphasized the meaningfulness and excitement of this conference. One teacher said, "I think it charged me up--renewed vigor and interest. We were able to bring back information and share it with other teachers. Teachers from all over the country had profound respect for teachers from Philadelphia. When they saw our badge, they automatically gave us a salute." Another stated, "It gave me a chance to network, to see what was working with other teachers. It was a good learning experience--a real shot in the arm for me. I experienced the professionalism of teaching. You don't always feel professionalism when teaching in Philadelphia. It takes an NCTM meeting to realize that. I felt that I was looking for ways to make me a better teacher. There wasn't enough at a high school level to use with a general math class. I went to junior high school things. We are often the forgotten teachers." A third teacher added, "We met members of the collaboratives from all over the country. We had common concerns."

NECC Conference. The collaborative and the Technical Assistance Project funded nine teachers, including two from target schools, to attend the National Educational Computing Conference (NECC), held June 24-26, 1987 at the Convention Center in Philadelphia. The conference was well attended and appreciated. One teacher commented, "The school district should make this kind of meeting available to more people. I have really enjoyed it and got a lot out of it." Another said, "I've never been to this kind of conference. It's nice--really nice. I've been to book fairs. These exhibits are much more interesting."

Mini-grants: Classroom Projects

The Philadelphia Math Science Collaborative also supported mini-grants from other sources by providing in-service and consultation to teachers preparing proposals. During the 1986-87 school year, PRISM awarded fifty-five mini-grants to teachers or to groups of teachers to support innovative and experimental projects designed to enrich classroom experiences in mathematics and/or science. Fifteen grants went to mathematics teachers, three of whom taught in high schools. Grants of $300 were made to individual teachers, while groups of teachers who collaborated on a project received up to $3,000. A mini-grant fair was held November 12 at which projects funded by mini-grants were featured.

During the 1986-87 school year, the collaborative made a concerted effort to assist teachers in the six target schools in applying for mini-grants. The coordinator met with teachers to help them identify and develop program ideas, and the collaborative provided technical support (including typing) for the grant requests. In order to encourage further applications, a session on writing mini-grant applications, led by PRISM documenter Elizabeth Haslam, was held for mathematics department heads in December, 1986.

TARGET SCHOOL ACTIVITIES

Department Meetings

Each mathematics and science department is directed by the school district to hold a monthly meeting; these generally occur on the second or fourth Tuesday of each month. In line with its goal that mathematics and science teachers interact on a more regular basis, the collaborative required that a minimum number of department meetings are held jointly.

The collaborative's impact on these department meetings has been clear in a variety of ways. For example, the collaborative has been instrumental in arranging for some of the joint department meetings to be held at The Franklin Institute, including the October 24 meeting of twenty-five teachers from Dobbins Area Vocational Technical School. Participants commented that it was the first time that the mathematics and science teachers had an opportunity for formal interaction. This, and the information they received about The Franklin Institute, made the meeting very worthwhile.

The mathematics and science departments of Edison High School held a joint meeting on December 9 at The Franklin Institute. Eighteen teachers from Edison toured the Institute's newly reopened mathematics exhibit. Teacher reactions to the meeting were very positive.

As a result of collaborative encouragement, departments have met to review computer software; the science department at West Philadelphia High School met November 25, the science department at Martin Luther King High School met December 1-3, and the science department at Dobbins High School met December 5. On March 24, the collaborative organized a program on software by Scott Steketee, a professional writer of software and a teacher in one of the new target schools for 1987-88, for twenty-four members of the joint math/science department of Martin Luther King High School. The department heads found the activity to be very worthwhile.

When possible, collaborative coordinator Sue Stetzer attends department meetings. At these meetings, she has worked with teachers on a needs assessment, which included documenting the "base line" that represented the current level of activities of teachers in both "in-school" and "out-of-school" activities. She has also provided assistance to teachers in developing objectives for the school year.

Ms. Stetzer's department visits have had a very positive effect. One department chairperson who had previously not been involved in the collaborative contacted her for a recommendation of a speaker for a departmental meeting. He told Ms. Stetzer that he used to invite speakers to departmental meetings but had gotten lazy, and that "you really inspired me so I am getting it together." As early as November, this department head had scheduled programs for his department meetings all the way through March.

Workshops and Speakers

Target schools held a variety of workshops and presentations with the collaborative, many of which were funded through PRISM grants which the collaborative helped initiate. Speakers were very often invited to joint mathematics-science departmental meetings.

Each of the six target schools took advantage of Professional Enrichment Grants offered by the collaborative to send teachers to professional meetings, conferences, and workshops. In many cases, application for these grants was the direct result of regular contact between the schools' mathematics and science departments, and Sue Stetzer.

At West Philadelphia High School, college and university professors and school district personnel have spoken to eight department meetings on problem solving and other current issues in mathematics. Teachers have felt a new sense of professional involvement and have been able to devote time to the consideration of pedagogical issues within the constraints set by the district. These presentations were funded by a mini-grant from PRISM; Sue Stetzer, the current collaborative coordinator, applied for this grant while she was department head at West Philadelphia High School.

Edison High School sent five teachers to conferences, including NECC, the NCTM national meeting in Anaheim, and an Environmental Protection Agency seminar on pollution. Department head (Sue Stetzer) had applied for the money as a result of her involvement with the collaborative.

In general, the workshops were enthusiastically received. One teacher commented, "Each time we have had a meeting, they get better and better. I was getting tired of problems but they developed some strategies and it is all coming together." Some teachers have felt, however, that the workshops did not apply to the students they taught. One teacher said, "The problems given were great for us, but nothing that students would be able to solve. A lot of students don't even want to be in class, let alone solve problems." Another said, "Our problems are not with problem solving, it is with the academic level of our students. No one is addressing what we can do about raising the academic level. We are grappling with the fact that 66 percent of our kids are below the 16th percentile in math."

Roxborough High School had previously received a PRISM grant which funded staff training for utilizing computers to teach Mathematics in Application, a nonacademic third year mathematics course. Many of their activities were geared toward implementing the grant. For example, at a joint meeting of the mathematics and science departments on December 2, Dr. Miriam Yevick of Rutgers University discussed her book Mathematics for the Billions. Twenty-four teachers attended this presentation; while they felt that some concrete applications of mathematics were offered, their general response was that the talk was not as valuable as it could have been. This grant, obtained through the efforts of the department head, fostered collegiality among teachers.

On February 17, 1987, Sue Stetzer taught a spreadsheet workshop at Roxborough High School. The workshop was designed to instruct mathematics teachers on the use of spreadsheets in the Mathematics in Application course. Eight members of the mathematics department attended. The teachers felt the activity was worthwhile, and several suggested more time or training. They seemed to be excited that they could use Appleworks. One teacher commented, "Everyone was actively involved with the computers. Sue was well prepared." Another said, "Sue knew the material well. She has a dynamic delivery because she took time with us." Other comments included, "Sue presented the material slowly. It gave us a chance to digest it. I wish we could do it in the a.m. when we are wide awake. I was able to use a spreadsheet a week later and I knew how to do it." "I wish we had more time to do these things during schooltime."

A Roxborough High School teacher was awarded a PRISM grant for the 1987-88 school year to use the Geometric Supposer in her classroom. The department used Professional Enrichment Grants to send five mathematics teachers to professional meetings.

Involvement in the PMSC appears to have restimulated the mathematics department at Edison High School. Outside speakers were invited to address monthly departmental meetings. Representatives of the school district and Drexel University spoke to joint meetings of the math and science departments on topics ranging from Mathematics in Application to stoichiometry. Edison High School sent five teachers to conferences, including NECC, the NCTM national meeting in Anaheim, and an Environmental Protection Agency seminar on pollution. In addition, nearly the entire mathematics department attended the Mathematics Leadership Conference, and a degree of camaraderie was developed there.

The Overbrook High School mathematics department was unfamiliar with the use of computers to teach mathematics and invited Sue Stetzer to present workshops at department meetings. On March 26, 1987, Ms. Stetzer explained spreadsheets and ACCESS to fifteen members of the math department. Ms. Stetzer reported that the meeting went very well, and that the teachers were excited with the activity. The teachers discovered that they were able to perform well despite their fears of the new technology. The department won a PRISM telecommunications grant and funded four teachers' attendance at professional meetings.

For the past three years, the staff and students of Martin Luther King High School have been relocated in another building while asbestos was removed from the school. Students and staff will return for the 1987-88 school year. To date, the impact of the collaborative and the responsiveness to Sue Stetzer's efforts have been limited. The major result of collaborative involvement was the school's successful application for a modem grant. In addition, a teacher organized a presentation of Texas Instruments hardware, and a joint math-science presentation on software was presented by Scott Steketee. The school has also sent one science and one mathematics teacher to national conferences.

Teachers at Dobbins High School received three grants from PRISM: one which supplied modems in both the mathematics and science department offices, one which funded the mathematics department to purchase and use software in the classroom, and one for the purchase of an Apple IIGS system for the science department. Dobbins also sent three teachers to the Mathematics Leadership Conference.

F. Observations

The Philadelphia Math Science Collaborative has made great strides since it was reorganized in the latter half of 1986. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The hierarchical structure of the PRISM organization is something of a double-edged sword in relation to the involvement of groups other than the teachers. On the one hand, it protects the collaborative from the need to expend too much energy in raising funds. At the same time, however, it tends to set an additional distance between nonteacher participants and the actual activities of the collaborative.

The scope of PRISM's documentation component currently includes the Philadelphia Collaborative. This initiative is staffed by Dr. Elizabeth Haslam, who has visited each participating school and interviewed a teacher and several students at each site on three occasions. Dr. Haslam has developed a good sense of the dynamics of the schools concerned, and has provided valuable input and a fresh perspective to Sue Stetzer as coordinator at their regular meetings. A report was produced at the end of the school year.

With the departure of the PRISM director to Colorado, the organization's future is unclear. This situation has a set of implications for the governance and funding of the collaborative.

The real organization of the PMSC at an operational level consists of Sue Stetzer, Wayne Ransom, Joyce Neff, and, to a lesser extent, Elizabeth Haslam; these four individuals meet formally each month for planning, review and implementation. There is concern about the low level of involvement of the Advisory Council as both a planning and a policy group. As a result of the lack of communication between board members there has been little coordination at times, among the activities of various organizations. For example, the collaborative's coordinator was not advised of teacher workshops organized by Drexel University. In part the problem is one that has arisen from the previously described PRISM structure, but it is probably more a historical than a determining condition.

A conscious effort has been made to increase the Advisory Council's involvement in policy formation, with Dr. Ransom and Ms. Stetzer establishing responsibilities for board members. This restructuring of the board will provide an opportunity for more meaningful involvement and participation of its members.

Sue Stetzer has brought both the needed vision and the energy to the Philadelphia Math Science Collaborative. During the 1986-87 school year, she was on leave from her position as a department chair and was paid by the Philadelphia school district. The Franklin Institute partially reimbursed the school district, providing the funds to pay the salary of the teacher who taught in Ms. Stetzer's place. This arrangement, however, could only be made for one year. Ms. Stetzer has agreed to continue in the position as coordinator. This required negotiations with the union and action by the school board; in addition, Ms. Stetzer lost her rights to the position of department head at her former school. She does, however, retain the right to take up a corresponding position there or in another school. Ms. Stetzer's commitment to continuing as the coordinator on a more permanent basis is seen as a significant development, as her leadership has been very important to the vitality of the collaborative.

The credibility of the collaborative has been established among the teachers as a consequence of the initial goodwill and status that Ms. Stetzer brought to her role as coordinator, and as a result of her spending a lot of time in the participating schools. In fact, the collaborative is often defined by teachers as "what Sue Stetzer does." This is probably inevitable to a great extent in that the project operates in a resource-rich environment, with organizations such as PRISM, PTIP and PRIME all engaging in educational support activities that impact on the work of significant numbers of mathematics teachers. It is useful for teachers to identify a particular project with a single person. It is also an outcome of Ms. Stetzer's very active strategy and the time she has spent in the target schools, identifying the project as a networking and clearinghouse service for teachers. In this way, the collaborative has been able to establish an identity for itself: a task that has posed problems in the past. It will always be difficult to differentiate clearly the project from the rest of PRISM, and it may be a futile task to try to so do beyond a certain point.

Ms. Stetzer's linkages with the district and local mathematics education organization have been critical in the recasting and establishment of the collaborative as one with a future in Philadelphia. The collaborative is now an active and identifiable entity within the complex of support offerings for teachers in the district. As the on-site observer noted, "The collaborative has become a real part of the Philadelphia math/science educational scene." The project has established a niche for itself in promoting school-based programs. This focus fits well with the effort of the coordinator to be physically present in the schools, and to engage the teachers in each target school in organized activities.

As part of Ms. Stetzer's plan to establish an identity for the collaborative, she has made a concerted effort to be sure that others in the community are aware of its existence and programs. She spoke at a committee on collaboratives chaired by Dr. Kelner of the school district. At that meeting, Ms. Stetzer distributed the "Apple for a Teacher" flier and talked about how teachers should be aware of the collaborative. Representatives from Penn State, Penn, Temple and PRISM, as well as various school district personnel, were in attendance.

In her position as project coordinator, Ms. Stetzer is able to enhance the professional life of mathematics teachers beyond the activities of the collaborative. She was, for example, asked to suggest teachers who would receive invitations to hear Seymour Pappert speak, even though his presentation was not sponsored by the collaborative.

COLLABORATION

The collaborative's emphasis on six target schools has introduced a new element of collaboration into support activities in Philadelphia. In the past the collaborative had focused its efforts on encouraging teachers to participate in the wide variety of activities offered to mathematics teachers by PRISM, the Committee to Support Philadelphia Public Schools and other organizations. With the establishment of the Math Science Collaborative, the project has initiated activities directed at forming cohesion between the mathematics and science departments within the target schools. For example, one of the prerequisites for becoming a target school is that the math and science departments hold a number of joint departmental meetings. This has certainly helped to foster communication and perhaps an initial level of collaboration among the teachers in the two departments at each school.

The collaborative newsletter has been very successful in contributing to communication and collaboration, and appears to be well read. Dr. Alex Tobin, director of PRIME, commented that as a result of a short newsletter article about an NSF math project, he received numerous requests from teachers and from one school board member for more information.

The collaborative has begun to encourage cooperation within the Philadelphia educational community. For example, as a result of contacts established through the Philadelphia Math Science Collaborative, ATMOPAV and Temple University have worked closely together in organizing the association's annual meeting on that campus. This is the second time since the collaborative was established that a university has offered ATMOPAV its facilities. In 1985, Drexel made a similar gesture.

Building business-school alliances is currently being explored in order to create networks between mathematics teachers in the target schools and others associated with the use of mathematics. To date, the local energy company and two other local corporations have been approached. If successful, this activity will further broaden the scope of collaboration in Philadelphia.

Ms. Stetzer's determination to further involve the collaborative board is important for a number of reasons. First, if networking is to occur between interest groups, then it must be effective at the board level. Second, if the tradition of outside provision of service to teacher clients is to be successfully challenged, then the changed relationships necessary will have to manifest themselves at the policy-making and decision-making levels. Third, if teachers are to be best supported in their efforts to change the quality of their work, then effective and frequent communication is essential.

PROFESSIONALISM

The collaborative's strategy has focused on interdepartmental collaboration and helping teachers decide which activities they feel would be most productive. For example, the collaborative has supported teachers' efforts to seek mini-grants; while the grants came from outside resources, the initiative for teachers to submit a proposal came from their association with the collaborative. Teachers are beginning to feel that they can take the initiative to improve their professional lives.

As teachers within a school work together to take greater advantage of outside resources and activities, it is possible that the nature of the collaborative's offerings will change. What goes on within the schools will impact upon what activities will be offered in the future and what dynamics will be used to encourage teachers to participate in those activities.

Ms. Stetzer's capacity to alert department heads to available resources has occasionally resulted in a tendency on the part of some departments to rely on being "fed." The collaborative has resisted this response and, as a result, failure to assume the responsibility to stay informed has, in a few instances, caused a department to miss the opportunity to obtain equipment grants or conference support.

The relationship between the teachers in the target schools and the bureaucratic demands of the school district, such as the mandated curricula, will warrant careful observation during the next few years. As teachers in these schools gain power and collaboratively develop improved programs within schools, they will challenge current curriculum policies. The ways in which such challenges are negotiated within the Philadelphia schools should be of interest to the Ford Foundation and others interested in curricular and institutional change.

The release of significant numbers of teachers to attend the Geometric Supposer workshop was a new step for the district, and one that could represent a significant development in the district's attitude about freeing teachers to attend enrichment activities. The cooperation of two district offices in setting up the activity and releasing of teachers was essential, particularly as the workshop was developed outside the district organization.

MATHEMATICS FOCUS

The collaborative, which has been active in providing teachers with a broader sense of mathematics, has emphasized department meeting presentations that stress problem solving and mathematics applications. An effort also has been made to provide teachers with software so that computers can be used more effectively in mathematics instruction. In addition, the collaborative has encouraged and helped to facilitate teachers' attendance at professional meetings. Teachers' attendance at professional mathematics education meetings will keep them current on mathematics education issues. It is too early to predict how these experiences will impact on classroom teaching. It will be interesting to see how the new ideas to which teachers are exposed are integrated into the mandated curriculum. What is evident is that the Philadelphia Math Science Collaborative has made great strides toward infusing teachers with a more enlightened view of mathematics.

G. Next Steps

In order to broaden the collaborative's leadership base, and to increase the proactive role of the Advisory Council, a major focus of the project for the next twelve months is the restructuring of its Council. Members have been asked to volunteer to serve on one of three committees (steering, program planning, and communication). These will assume increased visibility as part of the attempt to generalize perceptions of the collaborative beyond the role of the coordinator.

Three additional target schools have been recruited for the 1987-88 school year. Two of the three schools are typical inner-city schools. The third, the High School of Engineering and Science, is a desegregated magnet school for math and science in the heart of North Philadelphia. The three schools all bring a common interest to the collaborative. They are interested in participating in a proposed Geometric Supposer Network; all three participated in the Supposer workshop and were enthusiastic about the software. They all have access to computer labs for teaching geometry using the software and all have modems to provide a telecommunications link with their counterparts in other collaboratives across the country.

The immediate concern of the Philadelphia Math Science Collaborative is the establishment of close ties with the nine target schools. With the reorganization of the collaborative, the focus has shifted from serving mathematics teachers to linking mathematics and science departments. The collaborative will continue to arrange joint departmental meetings within each school to foster the exchange of concerns, ideas, and information. The collaborative also will continue to promote dialogue among the mathematics and science teachers in the six target schools. Next year, the number of target schools will be increased to nine.

The collaborative will continue to organize "Meet the Directors" sessions. These meetings give mathematics and science teachers the opportunity to become better acquainted with the district's curriculum directors, as well as with one another.

The collaborative will continue to develop ACCESS, the Math in Application Network that it initiated in fall, 1986. Additional software will be distributed as teachers submit materials. The collaborative is considering establishing a similar network for science software.

In order to encourage teachers to attend professional conferences, the Philadelphia Math Science Collaborative will provide funds for some teachers to attend meetings, such as those of the Pennsylvania Council of Teachers of Mathematics, NCTM and NSTA. The collaborative will again pay for teachers to attend mathematics and science conferences.

PRISM sponsors an ongoing curriculum forum on a variety of topics for grades K-12. The coordinator of the collaborative will help organize and support this forum; PRISM, however, will provide all of the funds.

During summer, 1987, local colleges will offer short courses or Institutes. A short course on calculus will be held at Chestnut Hill, a course on discrete mathematics will be held at Beaver College, and a Woodrow Wilson Institute on statistics, cosponsored by the collaborative, will be held at the community college.

SUMMARY REPORT:
PITTSBURGH MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Pittsburgh Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Pittsburgh Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM conference in April, 1987, in Anaheim, California; survey data provided by teachers; and three site visits by the staff of the Documentation Project.

PITTSBURGH MATHEMATICS COLLABORATIVE

A. Purpose

The six goals articulated in the initial proposal for the Pittsburgh Mathematics Collaborative continue to provide focus for the collaborative. The project's goals are:

1. to overcome teachers' isolation and to increase opportunities for interaction;
2. to educate the community about the professional nature of high school mathematics teachers;
3. to enhance teachers' knowledge base of mathematics applications;
4. to provide opportunities for professional self-enhancement;
5. to provide opportunities for teacher recognition; and
6. to provide time for teacher interaction, work, and professional development.

The long-range goal of the collaborative, as stated in the 1986 proposal for continued funding, is the institutionalization of a set of structures and processes that will continuously foster teacher professionalism and will be decreasingly reliant on external administration and facilitation. Attainment of this goal is partially dependent upon the identification of resources to cover ongoing program costs. In light of this goal, collaborative activities are guided by a vision that by 1990, Pittsburgh will have:

1. an energized secondary mathematics faculty, deeply involved in mathematics curricular and policy issues, and continuously interacting with the larger community;
2. a community that is knowledgeable about secondary mathematics issues and appreciative of secondary teachers;
3. a series of mechanisms in place to promote exchange and interaction among teachers and community leaders in business, industry, and higher education; and
4. a public more aware of the importance of mathematics in students' educational development and in adults' professional lives.

B. Context

The Pittsburgh metropolitan area has a population of 2.5 million. The city itself has a population in excess of 400,000. The area is served by the Pittsburgh Public Schools District. Dr. Richard Wallace, Jr., the superintendent since the 1980-81 academic year, has announced that he will retire in 1990. The central office support for curriculum areas was reorganized at the start of the 1985-86 academic year. As a result of the reorganization, Dr. Diane Briars was appointed in February, 1986, to the then newly created position of associate director for mathematics.

A school closure program is nearing completion, with eighteen schools closed over the past seven years. The district serves approximately 40,000 kindergarten through twelfth-grade students. Of the student population, approximately 50 percent are black and 50 percent are white, with other minorities, including Asians, represented in only small numbers. The organization of the schools has been standardized so that all twelve high schools are comprised of grades 9-12, all sixteen middle schools are comprised of grades 6-8, and all forty-eight elementary schools are comprised of grades K-5. Good relations exist between the superintendent's office and the local teachers' union.

The district has 126 high school mathematics teachers. Of these, ten are black. All 126 teachers are fully certified to teach mathematics and average twenty years experience in the classroom. The district has done little recruiting for some years, as its population has declined; this year, for example, only two new teachers were hired. Teaching positions will soon open as teachers in this maturing teaching force retire.

The district has actively addressed its declining enrollments and its desegregation plan. Two high schools have been merged into one for the 1986-87 school year, reducing the number of high schools in the district to twelve. Magnet schools provide a means of voluntary desegregation. The value of some magnet programs became evident in November, 1986, when parents waited in lines in below-freezing temperatures for four days to register students in magnet middle and high school programs.

In the fall of 1985, teachers received a three-year contract. In January, 1986, Superintendent Wallace secured a four-year contract. Together, these contracts will help to ensure stability in school district working conditions through 1988.

The teachers' union is strong. Consequently, considerable detail is written into the contract. For example, all teachers get two or three Mondays or Fridays leave so that they can have an occasional three-day weekend. (On one of those days, Friday, February 27, the collaborative sponsored a trip to a nuclear plant.) The top salary for the current school year is $39,000; it will be $40,000 next year.

A high school day consists of seven periods, with a twenty-minute homeroom period at 7:40 a.m. The day runs until 2:20 p.m. Teachers teach five classes, and have one free period and one duty period (study hall, hall guard, etc.). Principals are considered school leaders; they appoint the department heads and set the schedule. The principal can ask for help from the department head, who is paid an additional $1,200 per year and gets one extra free period per day. Teachers serve on committees, such as those focusing on textbook selection and curriculum development. Assignment to these committees is desirable because they meet for two weeks during the summer and teachers receive extra pay. Summer school teachers are selected based on seniority. The summer school program lasts six weeks and, until recently, focused primarily on remediation. The schools operate on a full year, rather than a semester, schedule. Some consideration is being given to returning to a semester schedule so that students who are failing at midterm can repeat the course, rather than failing a complete year.

As of this year, students need three years of mathematics to graduate. However, this can be achieved in many ways. For example, students can take two years of general math and a senior review, or one year of general math and two years of Algebra 1. The district is now working on a revised General Mathematics 1, 2, 3 sequence. Students are also required to pass a competency test to graduate; if they fail the test in tenth grade, they must pass the Business Mathematics class in order to graduate.

Teachers have been required to attend two full-day inservices that are structured by the district's associate director for mathematics and two half-day inservices directed by the principals. This year, the collaborative planned the two half-day inservices previously led by the principals. Teachers can take increment credit courses in order to move up the pay scale. One such course, "History of Ideas in Math," was taught by the district's associate director, Dr. Diane Briars, from 4 to 6 p.m. on eight to ten consecutive Mondays. The secondary mathematics supervisor, Howard Bower, has organized another course, "Calculus Review," which is being taught by a retired mathematics teacher.

Schenley High School and Teaching Center, which was built more than 50 years ago, has recently been renovated. About 1,000 students attend the school. Two-thirds of the students are black; many of the remaining one-third are Asian. Two magnet schools are housed at Schenley--the International School and the High Technology Magnet School. Most students in the International School have been together since elementary school. The student population at the High Technology magnet is comprised of an equal number of minority students and white students. For every black student who is accepted, one white student is accepted. If a student of one group applies and there is no application by a student of the other group, enrollment is frozen until such time that two students--one black and one white--can be admitted. Students in the magnet schools mix with students who attend Schenley's regular program.

The Teacher Center, which has been operated by school district staff for four years at Schenley High School, may be abolished next year. Nearly all of the secondary school teachers in Pittsburgh have spent an eight-week session at the center learning about PRISM (Pittsburgh Research-based Instructional Supervisory Model) and teaching.

The PRISM program, designed to improve instructional and evaluation techniques, is based on an adaptation of Madeline Hunter's Effective Teaching Model. The model describes the four major elements of effective instruction:

1. Select an objective at the correct level of difficulty.
2. Teach to an objective.
3. Monitor the progress of the learner and make adjustments in the teaching.
4. Use, without abuse, certain principles of learning.

Since 1981, when the PRISM program was initiated in the district, first principals, and then department chairs, were trained to perform teacher observations. Over the past six years, all of the secondary mathematics teachers have been trained at Schenley. In their absence, classes were taught by trained "replacement teachers."

At the Teacher Center, each teacher is assigned to a Clinical Resource Teacher (CRT). CRTs have the same seven-period day as other teachers, but they teach only three to four high school classes. Instead, they have one preparation period, one period with each of the teachers assigned to them, one period teaching a class of teachers, and one duty period. The assigned teachers attend classes, work with their assigned CRT, and do special projects. During the training, four areas are stressed--critical thinking, higher order questioning, testing, and progressive discipline. In addition to covering Madeline Hunter's model, the teachers may attend lectures on educational psychology, development theory, and mathematics topics such as problem solving using calculators and computers. Every second week during each eight-week session, teachers participate in an internship chosen by them and their CRTs. An internship may involve working in industry or completing a special project at home. After teachers leave the center, specially trained teachers observe them in their classrooms.

The impact of this training is noticeable. Teachers inculcate the Hunter model into their own classroom activities. In one case, an observer noted that a geometry teacher followed the recommended procedure of writing the day's objective on the board; used guided practice by checking understanding by requiring a student to answer a question; and provided instructional input by reviewing the applicable rules.

Since 1981, the school district also has implemented the Monitoring Achievement in Pittsburgh (MAP) program, an instructional testing system designed to increase student achievement in basic skills. Superintendent Wallace formed the MAP committee to allow teachers to formulate objectives for each grade level and tests to evaluate their achievement. Diane Briars is currently arranging for the MAP mathematics committee to review the objectives in order to eliminate those that are no longer considered relevant, and to include emphasis on such areas as problem solving.

Components of MAP include the identification of skill expectations, focused instruction, the monitoring of achievement, appropriate instructional resources, attending to time on task, and staff development. The MAP Mathematics Program covers objectives for grades 1-8, General Math, Algebra I and II, Geometry I, and Consumer Math. All students mainstreamed in these grades and courses take multiple-choice tests on twenty to thirty-one objectives at each level; one test item is used for each objective. The tests are computer scored, and the results are reported on the Class Diagnostic Summary and the Student Achievement Report.

The district's next initiative will involve establishing Centers of Excellence at each high school. In each school, a shared governance committee of administrators and teachers will identify an educational project. At Schenley High School, for example, the committee meets after school to discuss ways to get better test results from their calculus students. At another school, the staff has chosen to focus on the difficult time the students have had making the transition from eighth grade to ninth grade.

C. Development of the Collaborative

For most of the 1986-87 school year, the Pittsburgh Mathematics Collaborative was administrated by Coordinator Dr. Leslie Salmon-Cox and Assistant Coordinator Dr. Martina Jacobs. Dr. Salmon-Cox is affiliated with the Learning Research and Development Center at the University of Pittsburgh. In March, Dr. Jacobs resigned from the project to become director of Kaufman's Triangle Program, an initiative to support area women in careers. On April 15, Ms. Barbara Bridge became assistant coordinator of the Pittsburgh Mathematics Collaborative. Ms. Bridge, who holds a master's degree in communications, has a strong background in marketing and sales. She has worked at the Pittsburgh Press, and more recently, at the Pittsburgh Post-Gazette, where she developed curricula for the use of newspapers in classrooms, acted as liaison between the newspaper and local educators, made in-school presentations, and conducted tours of the newspaper facilities for students and teachers. Ms. Bridge will work jointly with the collaborative project and with Jeanne Berdik in the Partnerships in Education Program (PIE).

Dr. Diane Briars, the school district's associate director for mathematics, provides a major link between the collaborative and the district. The on-site observer is Ms. Rosemarie Kavanagh, a retired mathematics teacher.

Collaborative governance is shared among the Steering Committee and its Executive Committee, both of which were actively involved in writing the initial proposal, and a group comprised of the department chairs from each of the high schools. The Steering Committee meets once or twice annually to discuss the direction and activities of the collaborative. The department chairs met monthly throughout the school year to work on specific activities, such as planning inservice workshops. The department chairs act as the major communication channel between the collaborative's administration and the teachers. In 1985-86, there were thirteen department chairs; the merging of two high schools in 1986-87 reduced group membership to twelve. Both the secondary supervisor and Diane Briars work closely with the department chairs. As a result of its activities during the first year of the collaborative and of the interaction between the collaborative coordinator and the school district administration, the department chair group has increased in status within the district and is now referred to as the Mathematics Curriculum and Policy Advisory Committee.

Steering Committee

A twenty-nine member Steering Committee was established in spring, 1985. The committee is comprised of three representatives from the school district administration; four teachers; three representatives from universities; one from a community college; five from institutes and foundations; five from community councils; five from corporations; one from the Buhl Science Center; one from the Federation of Teachers; and the collaborative director. At their initial meeting, members of the Steering Committee stressed the importance of coordinating the needs of industry with the education of future employees.

The Steering Committee met on December 11, 1986, to review the collaborative's accomplishments and current goals. Concerns included students' failure to understand the need for mathematics and the consequent low enrollment in mathematics classes, and disinterest in the collaborative by some district teachers. In response, the committee suggested that the collaborative should air mathematics programs on WQED, the educational television channel, and encourage teachers to attend a dinner meeting. The committee also discussed involving all high school mathematics teachers in the collaborative and the potential future scarcity of mathematics teachers in Pittsburgh. It was noted that middle school teachers would like to be involved in the collaborative; collaborative representatives explained the Ford Foundation's funding conditions that limit their participation, and suggested ways that middle school teachers may participate in some activities. Participants suggested pairing high school and middle school teachers for classroom visits. The committee felt that meeting more often than twice each year was unnecessary unless a particular need arose.

Executive Committee

A small group comprised of Leslie Salmon-Cox (Pittsburgh Mathematics Collaborative), Barbara Bridge (PMC and PIE), Diane Briars (Pittsburgh Public Schools), Nancy Bunt (Allegheny Conference on Community Development), and Jeanne Berdik (PIE) meets monthly to review collaborative activities and plans. This group, which meets the first Tuesday of each month, is referred to as the "First Tuesday Committee." Its regular meetings facilitate the coordination of the collaborative's major resource components, particularly in terms of establishing a link with the school district.

Curriculum and Policy Advisory Committee for Secondary Mathematics

The mathematics department chairs have evolved into a strong group which, in the latter part of this year, became the Curriculum and Policy Advisory Committee for Secondary Mathematics. There is now a growing emphasis on involving teachers other than department chairs.

The mathematics chairpersons from each high school met with Dr. Briars monthly during the 1986-87 school year. Meeting topics ranged from calculators in the classroom to honoring innovative teachers. In July, for example, the chairpersons met with Dr. Salmon-Cox to review the collaborative's progress during the 1985-86 school year and to highlight plans for the fall. Dr. Briars and Dr. Salmon-Cox reported that a placement guide to help counselors place students in mathematics classes had been developed and that calculators had been ordered. The group agreed that each department would decide how best to distribute the calculators within each school, and that district-wide policy would be developed in spring, 1987. The committee met again in September, October, November, and December.

At the first meeting of the second semester, the chairpersons discussed a method for choosing a "teacher of the month" at each school as a means of recognizing innovative teachers and boosting morale. (A different school was to be highlighted each month.) Other agenda topics included resource materials that had been ordered, the February In-service, Mathematics Awareness Month (April), and future meeting dates. One chairperson reported on conference meetings that could qualify for professional development teacher grants, and a listing of these was distributed.

Since the first meeting of the Mathematics Instructional Chairs held in November, 1985, the group of department chairs has evolved from individuals who had never met together into a close working group.

D. Relationship with Other Local Initiatives

The Pittsburgh Mathematics Collaborative was designed to build upon local initiatives. The collaborative's work is integrated with the initiatives of the Pittsburgh Public Schools, the Allegheny Conference on Community Development (ACCD) Education Fund, PIE, local universities, vocational training programs, and other community-based programs.

The Pittsburgh Mathematics Collaborative engages in joint projects with the public schools that work toward attaining the district's goals: curriculum reform, establishing mathematics resource centers, computer literacy training for teachers, increment-credit course development, and pilot testing of textbooks. In these joint projects, the role of the Pittsburgh Mathematics Collaborative can include publicizing the activity, organizing individual events, facilitating those events organized jointly with district personnel, and assisting the district in obtaining outreach funding, such as in the case of computer training.

Through ACCD and PIE, the collaborative establishes contacts with representatives of business and industry. The collaborative capitalizes on existing relationships between corporations and schools, enlisting support from corporations particularly interested in mathematics education. For example, the collaborative arranges site visits to various businesses at which teachers receive information about the sponsoring corporation, about important future directions and job potential in the corporation, and about the mathematics required to perform these jobs. Teachers and corporate representatives are encouraged to discuss the mathematics preparation needed for successful entry into the workplace.

The extent to which the collaborative cooperates with other local initiatives is well illustrated by the visit of Professor Zalman Usiskin in April, 1987, an event that was cosponsored by the collaborative and the Allegheny Conference. The school district provided substitutes so that forty-five teachers could attend for the day. The department chairs and members of other teacher committees were among the teachers who participated. Some of these teacher committees began as a result of the collaborative's efforts.

The Pittsburgh Mathematics Collaborative strives to foster a positive and accepting environment at local universities for the benefit of high school mathematics teachers; the collaborative's goal is to develop a collegial relationship characterized by mutual respect between teachers and university faculty.

The collaborative has cooperated with the University of Pittsburgh in writing a proposal to create six tuition-free fellowships for secondary mathematics teachers to enroll in graduate-level courses. The proposal awaits final approval of the new university provost, who will be appointed in fall, 1987. The collaborative and the University of Pittsburgh also have discussed developing joint mentor programs for student mathematics teachers, and the role of the collaborative in a program to recruit bright undergraduates to careers in teaching. Plans are underway to work with other institutions of higher education in the Pittsburgh area.

E. Project Activities

During the 1986-87 school year, Pittsburgh's 126 secondary mathematics teachers were offered the opportunity to participate in a variety of collaborative activities, including a reception, seminars, computer training, curriculum development involving the use of calculators, and tours of local industry (many of which were scheduled on designated teacher inservice days). These activities are described in the section "Collaborative Sponsored Activities."

The collaborative also paid teachers' expenses to enable them to take advantage of professional opportunities offered by other local organizations, including professional meetings and a lecture series. The collaborative also cooperated with other local initiatives to help teachers develop and submit applications for professional enrichment grants. These activities are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

Collaborative Reception

On Monday, June 16, 1986, a reception for Barbara Nelson of the Ford Foundation was held in the U.S. Steel Building to celebrate the first year of the Pittsburgh Mathematics Collaborative. Fifty-nine people attended, including teachers, representatives from business and industry, and university faculty. Barbara Nelson presented a comprehensive review of the activities of the other collaboratives, and Leslie Salmon-Cox provided a summary of the year's activities of the Pittsburgh Collaborative. The reception also provided collaborative participants an opportunity to socialize. The department chairpersons met with Ms. Nelson prior to the reception to share their thoughts on various mathematics issues and their ideas about the future of the collaborative.

Dinner Meeting

On September 29, 1986, the collaborative invited all secondary mathematics teachers to a dinner meeting and lecture/overview on "Economic Development in the Pittsburgh Region." Fifty-one teachers attended.

Beaver Valley Power Station Tour

The Duquesne Light Company, in conjunction with the Pittsburgh Mathematics Collaborative, sponsored a tour and discussion at the Beaver Valley Power Station on February 27, 1987. Sixteen teachers attended. The program included an overview of Duquesne Light Company and the Beaver Valley Power Station (which is obsolete and being phased out), as well as a station tour and demonstrations of a simulator used in training, the emergency support system, and an operation system or model of a new facility under construction. Following the tour and demonstrations, lunch was served, teachers participated in an informal discussion, and Beaver Power personnel, some of whom had taught mathematics or science in the public schools, discussed math and science applications. Participants received handouts about various aspects of the nuclear power industry, as well as sample mathematical problems encountered by various employees at the power station.

The presentations were well received by the teachers and generated so many questions that some of the planned tour had to be cancelled due to time considerations.

Seminar on Mathematics and Proprietary Schools

On April 1, 1987, the Pittsburgh Association of Private School Administrators and the Pittsburgh Mathematics Collaborative cosponsored a seminar at the Gateway Club in Pittsburgh. The program, entitled "Mathematics and Proprietary Schools," featured a panel of representatives from Pittsburgh area proprietary schools (privately operated, postsecondary institutions that offer short-term programs, such as an associate degree in specialized technology or specialized business). They discussed the mathematics background needed by their students, the mathematics offered in their programs, on-the-job uses of mathematics, perceptions that mathematics students bring with them, and effective training techniques. Eleven proprietary schools, including schools of fashion design, business, beauty, and health sciences, participated in the program. A reception with refreshments concluded the event.

As part of the general discussion following the panel presentations, the difference in teaching students in public schools from those in proprietary schools was pointed out. A mathematics teacher at a community college noted that the students in community colleges and in technical schools were more mature and more attentive and motivated. Part of this the teachers attributed to the fact that the students were now paying for their education and had a specific goal/job in mind.

Computer Training

In August, 1986, the Pittsburgh Mathematics Collaborative received a $20,000 challenge grant from the Pennsylvania Ben Franklin Partnership Program to train a select group of secondary mathematics teachers to become computer literate. Ten teachers were trained to use computers to teach mathematics over the course of the 1986-87 school year; these teachers are expected to become peer instructors in their individual schools. Each teacher was loaned a home computer. The program included evaluation of currently available software, including the use of spread sheets for administrative functions. The teachers will spend five days during the summer of 1987 designing specific lessons that integrate computer software. They expect to pilot some of it next year in their classes. A second-year proposal to the Ben Franklin Partnership Program has been approved and will provide funding for a pilot project during the 1987-88 school year to continue and broaden the teacher training process in one large high school.

Calculator Curriculum Planning

During the summer of 1986, the collaborative funded six teachers to work for a full week with Diane Briars to develop district plans for the use of regular and scientific calculators in general mathematics courses. During the 1986-87 school year, teachers were asked to provide feedback on the plans, and a calculator-per-student policy was adopted. Most teachers reported that the calculators are useful.

In-service Programs

Equibank Tour. The collaborative arranged for teachers to tour the Equibank Headquarters on Friday, October 3, 1986, as an inservice day for a cluster of three high schools. The activity allowed teachers to discuss various banking operations and their mathematics applications and implications with the staff and management of Equibank. Twenty-five teachers, seven supervisors, and two collaborative representatives attended. The bank president and a senior vice president responded to teachers' questions. The executives noted that the commercial phase of business needs employees with college degrees in credit analysis and accounting, while the consumer phase requires employees who possess skills in addition, subtraction, multiplication, division, and figuring percentages. The president agreed to provide teachers with a sample of the test the bank gives to job applicants, as well as sample problems that could be used in the classroom. A reception followed the tour and discussion session.

Westinghouse Nuclear Training Center Tour. On Thursday, October 9, 1986, a half-day inservice enabled the mathematics teachers of five high schools to tour the Westinghouse Nuclear Training Center. Two managers and an engineer reviewed the mathematics skills required for employment in the nuclear power industry. The teachers viewed training materials, including models of nuclear components and a control room simulator. It was difficult to complete the activity in the two-and-a-half hours provided. Tour evaluations were very positive. Teachers' responses to a question about the most valuable lesson they had learned included: "the need for advanced mathematics and science courses in entry level positions"; "the need to continue to teach fractions and the traditional measurement system"; "service opportunities offered to graduating seniors are not to be overlooked"; and "stressing math teaching is important--made me feel more valuable as a math teacher."

Junior Achievement In-service. On October 16, 1986, the collaborative sponsored an inservice program for teachers from Allderdice, CAPA, Peabody, and Westinghouse high schools. Forty-four people attended the program, which was a panel of participants in Junior Achievement programs (KMG Main Hurdman, Blue Cross of Western PA, and Equibank).

Presentation by Blue Cross. On Wednesday, October 24, all secondary mathematics teachers were required to attend a half-day inservice at which representatives from Blue Cross presented a discussion of spread sheets and their applications to work. The event was sponsored by the Pittsburgh Mathematics Collaborative in coordination with the school district. At the beginning of the session, Leslie Salmon-Cox summarized the activities of the collaborative and discussed its future plans. In addition, Jerry Smith presented a summary of a conference on computer applications he had attended at Exeter during the summer of 1986.

Dravo Automation Sciences Facilities Tour. The Pittsburgh Mathematics Collaborative sponsored a tour and seminar at the Dravo Automation Sciences (DAS) facilities on February 12, 1987. DAS is a division of Dravo Corporation, which specializes in factory automation, systems integration, and management information. Thirty-four participants attended the program, which included an overview of Dravo Corporation and the capabilities of the technology used and developed by DAS, as well as a tour of the facilities and a discussion of the training and educational background of DAS employees. One speaker expressed his concern that even good students are so dependent upon the calculator that an unreasonable answer often is not even questioned. Teachers responded that the current emphasis on estimation should help to correct this situation. The program ended with a general question-and-answer session and light refreshments.

Materials provided to participants included a breakdown of the academic training of DAS employees (with 18 percent holding no degree, 56 percent holding an associates or bachelor's degree, 23 percent holding a master's degree, and 3 percent holding a Ph.D.). Another handout listed DAS employees by major field of study. Handouts indicated that one-quarter of future jobs in the Greater Pittsburgh region will arise in the high-tech field.

Dravo had arranged for press coverage, and the meeting was highlighted on the six o'clock news. Tina Jacobs and one of the mathematics chairpersons were interviewed.

Presentation by Blue Cross. On February 19, 1987, Blue Cross of Western Pennsylvania presented a program on the actuarial profession for mathematics teachers from Brashear, Carrick, Letsche, Schenley, and South high schools. This presentation was arranged by the collaborative. Nearly sixty people participated, including seven district representatives from the Pittsburgh Public Schools. The program featured an overview of Blue Cross of Western Pennsylvania, a discussion of careers in the actuarial sciences, and a review of the mathematics an actuary uses. Demonstrations of the personal computer as a tool in risk management and the use of financial modeling software had to be cancelled due to technical problems.

The actuaries who addressed the group discussed the training needed for their jobs, including statistics, research methodology, logic, computer science, calculus, linear algebra, probability and mathematical analysis. The actuaries noted that even the company's accounting clerks were required to have about two years of algebra, some understanding of statistical terms, and a good background in logic, estimation, fractions, and decimals. The program ended with a question-and-discussion session and a wine-and-cheese reception. Each participant received a packet of information about actuary science.

Because the professions discussed at this program required fairly advanced mathematical training, some teachers felt the information did not apply to their students. One of the younger teachers who teaches "non-academically inclined" students commented that she merely regarded these meetings with industry as opportunities for her to acquaint herself with professions that might be available to her, not to her students. However, one employee of Blue Cross, who had only a high school education, said the most advanced mathematics her job requires involves figuring percentages on a calculator. Another attendee commented, "While it was desirable for teachers to learn about these professions to steer their academically inclined students in that direction, this level of achievement is unattainable for the target group of students to which this collaborative has addressed itself. . . . It is my opinion it would be more valuable to survey the mathematics being used by employees at the entry level. These contacts with industry are good in opening doors but the capabilities of the target group need to be addressed if the project is to reach its goal."

Rockwell International Tour. On February 26, 1987, Rockwell International offered a program to teachers from Allderdice, CAPA, Peabody, and Westinghouse high schools. This visit was arranged by the collaborative. Prior to the visit, the assistant project coordinator and a teacher had talked with officials from Rockwell about what teachers would be interested in seeing. Forty-four participants attended, including three district representatives from the Pittsburgh Public Schools. The program included an overview of the Measurement and Flow Control Division of Rockwell International, a tour of the valve engineering and research laboratory, a discussion and demonstration of a typical valve research project, and an overview of the use of mathematical modeling in business planning, sales, and marketing. The presentation emphasized computer science, which has become a necessity in drafting, engineering, and mathematical modeling and simulation of all types. The program ended with refreshments and informal discussion.

Participants received a chart of various categories of mathematics (arithmetic, geometry, algebra, analytical geometry, derivatives, complex variables, vectors, etc.) and computer use and the frequency with which each category was used (daily, weekly, monthly, yearly, almost never) by those working on typical research projects in valve engineering.

Participants were impressed by the amount of time and preparation evidently invested in the presentations. One attendee commented, "Rockwell International must have spent hours in preparation of their program . . . Their presentations were excellent. If the company is that anxious to cooperate with educators, maybe some other help could be secured from them."

COLLABORATIVE SUPPORTED ACTIVITIES

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

During the summer of 1986, the Technical Assistance Project at the Education Development Center funded a teacher to participate in a week-long conference at Phillips Exeter Academy in New Hampshire. The collaborative had notified teachers of the opportunity and identified the teacher that would attend. The conference focused on the impact on and application of the computer in the curriculum. Among the topics discussed were discrete mathematics, new developments in mathematics, and issues in mathematics education. Two teachers received funding to attend the Computer Conference at Phillips Exeter Academy in June, 1987.

Educator-in-Residence Lecture Series

During the 1986-87 school year, the Allegheny Conference Education Fund continued to sponsor a lecture series which members of the collaborative attended. On August 21, 1986, Al Shanker, President of the American Federation of Teachers, gave a presentation on the Carnegie Foundation Report, "Teaching, A Nation Prepared." Teachers, principals, administrators, Partnerships in Education Program coordinators, and corporate representatives attended this presentation at the U.S. Steel Building. Mr. Shanker noted that, as a result of teacher layoffs and their low salaries as compared with comparable jobs in industry, only 6 percent of current college students are interested in teaching. He predicted that unless salary scales and working conditions are improved, and class size is decreased, 50 percent of current teachers will leave the profession.

A second program in the Educator-in-Residence Lecture Series, cosponsored by the collaborative, the Pittsburgh Public Schools, and the Allegheny Conference, was held April 28, 1987. Dr. Zalman Usiskin, Professor of Education at the University of Chicago, gave a two-hour presentation entitled, "Reforming School Mathematics for Today's World.' The program focused on the increased needs of high school students for mathematical literacy. Dr. Usiskin stressed the importance of mathematical knowledge beyond that generally obtained in the two years of high school algebra, including statistics, probability, exponential growth, and linear programming, and noted that while mandating a third year of mathematics for all students might help provide this knowledge, it is important to provide interesting curricula for non-academic students.

Dr. Usiskin further suggested that mathematics and science need to be integrated, and that mathematics specialists should teach elementary students much as music or art specialists are currently employed in elementary schools. Dr. Usiskin noted that the Soviets are introducing algebraic concepts to their students in the third grade and suggested that if this were done in America, secondary students would be able to accomplish more in algebra classes since they would not be struggling with the elementary ideas. He further emphasized that especially at the elementary level, a large number of mathematics textbook pages present nothing new, and suggested that students therefore have a hard time adjusting to the pace required for algebra when they meet it.

From 10 a.m. to 3 p.m., Dr. Usiskin met with forty Pittsburgh Public School teachers, including secondary mathematics chairpeople, a committee working on the redesign of the General Mathematics Curriculum, and the Monitoring Achievement in Pittsburgh (MAP) Mathematics redesign group. The teachers found the experience very rewarding.

The Changing World of Academia and Work

On Monday, September 29, 1986, a presentation on economic forecasting was held in cooperation with the Changing World of Academia and Work Project (a program for counselors) at the Station Square. Carol Monaghan, Director of the Economic Development Committee, Allegheny Conference on Community Development, presented an overview of Pittsburgh's shifting economy. A film produced by Duquesne Light Company described changing economic conditions from the 1700s to the present and prompted a discussion, which was followed by dinner. Attendance was voluntary but was encouraged by the collaborative. Fifty-six mathematics teachers and forty-two counselors from the Pittsburgh and county schools participated.

Professional Enrichment Grants

In fall, 1986, the collaborative announced the availability of Professional Enrichment Grants for high school mathematics teachers. The grants, available through the Allegheny Conference Education Fund, provide teachers with an opportunity to attend professional meetings, workshops, and seminars, and to consult with fellow teachers and colleagues in the private sector. Individual grants may total up to $300. Teachers must submit grant requests sixty days before the event or meeting for which funding is being sought. Two grants were given in partial support of teacher travel to the National Council of Teachers of Mathematics annual convention held in Washington, D.C. Two more went to support travel to the Pennsylvania Council of Teachers of Mathematics Convention in Harrisburg. In a letter to Dr. Jacobs, one of the teachers who received a Professional Enrichment Grant wrote: "Thank you so very much for selecting me as a Professional Enrichment Grant recipient. I am thrilled! The $300 award is deeply appreciated. Thank you for helping teachers to feel like real professionals. The Mathematics Collaborative is a marvelous organization and is doing outstanding work in helping to upgrade the quality of mathematics education. I wanted you to know that all your efforts have not gone unnoticed! If I can be of any service to your organization, don't hesitate to ask."

Committee to Redesign General Mathematics

In response to a new state law that requires three years of high school mathematics instead of two, the Pittsburgh School District established a committee of five teachers and a supervisor to determine the content of that third year. Since its inception, the committee's task has been extended to involve redesigning the entire three years of what is now considered General Mathematics. The committee met monthly throughout the school year and engaged in curriculum writing over the summer, supported in part by the collaborative.

Langley High School Workshop

On January 21, 1987, the Pittsburgh Public School District held an inservice at Langley High School. All mathematics teachers from the Pittsburgh Public Schools were required to attend. Each teacher attended a general session as well as two sessions selected from a list of eight. The sessions included: The Graphics Calculator--An Alternative to Computer Demonstrations; Fractals--On the Cutting Edge of Mathematics; Tessellations by Transformation; Aerobics for the Brain--Mental Mathematics (a modern approach to estimation and mental math approved by the NCTM); Challenge of the Unknown: Problem Solving in the Real World (developed by the American Association for the Advancement of Science); Concrete Models for Teaching Integers and Some Basic Algebra Concepts; Math from the Mechanical Universe; and The Discussion Model in the Math Classroom.

F. Observations

During the 1986-87 school year, the Pittsburgh Mathematics Collaborative continued to make great strides. The collaborative's growth in four specific areas will be addressed: Project Management, Collaboration, Teacher Professionalism and Mathematics Focus.

PROJECT MANAGEMENT

There is a close, tripartite working relationship between Dr. Salmon-Cox, the coordinator of the collaborative project; Ms. Barbara Bridge, the new assistant coordinator; and Dr. Briars, the school district's associate director of mathematics. The three are in constant contact and, based on fairly clearly defined areas of responsibility, share much of the decision making. These three, a member of the Allegheny Conference staff, and a representative of the Partnerships in Education Program constitute the collaborative's Executive Committee.

The Executive Committee continues to be responsible for many collaborative decisions. The committee meets on the first Tuesday of each month to ensure coordination across the represented group. Diane Briars' participation on this committee, as well as the working relationship that has been established between her and Leslie Salmon-Cox, have resulted in a very close connection between the collaborative and the school district. As Dr. Salmon-Cox explained, "This relation was a matter of luck. Someone else could have been appointed the Associate Director for Mathematics and there could have been a completely different direction for the collaborative." Also, the addition of Barbara Bridge has helped to integrate the collaborative's activities with those of the Partnerships in Education Program.

Three elements of the project's administrative organization require comment. First, the direct involvement of Dr. Salmon-Cox in the day-to-day organizational and intellectual aspects of the project is unique among her counterparts in the other collaboratives. Dr. Salmon-Cox is very supportive of the collaborative. Some procedures, such as that which teachers use to apply for Professional Education Grants, are becoming routinized so that they do not require such effort. Dr. Salmon-Cox feels that, in about a year, as the collaborative becomes more established, the position of project coordinator should be phased out. Having someone fulfill the duties currently performed by the assistant coordinator, however, will continue to be a key element of the collaborative's structure. It is apparent that a distinct separation of responsibilities has evolved. As coordinator, Leslie Salmon-Cox deals with the politics of the district, while the assistant coordinator is responsible for all of the collaborative's initiatives that involve business and industry.

Second, the direct involvement of the school district has enabled the collaborative to develop activities that address the district's problems and priorities. This has, from the outset, provided the conditions necessary to foster teachers' and administrators' feelings of ownership in the collaborative's success.

Third, the complementary skills and knowledge of the three central planners has been reflected in the distribution of collaborative tasks and responsibilities.

Of primary concern to the collaborative over the next two years will be the institutionalization of structures and processes that will continue beyond the period that the collaborative is funded by the Ford Foundation. In addressing this concern, great care has been taken to ensure that all planning involves the associate director for mathematics, the department chairs, and the Steering Committee. In this sense, the collaborative acts not as a director, but rather as a facilitator whose role is to organize activity, to garner resources, and to establish new interactions and networks.

COLLABORATION

The regular meetings of the Executive Committee ensure close contact between the collaborative and the school district, as well as among the collaborative, the Allegheny Conference, and the Partnerships in Education Program.

Efforts have been made to establish political connections between the collaborative and the district by gaining the support of key people and by keeping these people informed. Among these contacts are principals and the president of the Pittsburgh Federation of Teachers. These connections facilitate the collaborative's efforts to provide recognition for teachers and opportunities for interaction. The Pittsburgh Mathematics Collaborative is also well linked to the school district through the Associate Director of Mathematics and other collaborative participants who serve on various district committees.

The collaborative's coordinator has chosen to work through the department chairs, to gain their support, and to increase their status in the district; the strategy has proven effective in that department chairs have formed a group whose members value meeting regularly. In turn, the district has granted this group greater responsibility for the mathematics curriculum--a change in district structure that could remain indefinitely. It is assumed that a strong department-chair group can be used to encourage collaborative participation among all the mathematics teachers. The collaborative has been successful in involving other mathematics teachers in curriculum revision task forces, as well as in conferences such as that held at Exeter.

The collaborative appears to be having some impact as a result of its work with the school district. In the past, inservice time was scheduled by the principals. All teachers at a school attended the same program, a practice considered by teachers to be generally unproductive. The collaborative asked to plan the inservices for mathematics teachers, a strategy which has resulted in other content-area people developing subject-related inservice programs. Teachers seem to feel they now get more out of the inservices. Furthermore, Secondary Mathematics Supervisor Howard Bower has indicated that the work being done to integrate calculators into the district's classrooms and to help teachers become more knowledgeable about computers probably would not have occurred if not for the collaborative.

The assistant coordinator has made a considerable number of contacts with area industries and businesses as a means of providing the collaborative with a strong community link. Representatives from business, industry, and the higher education community who have participated in site visits and other collaborative activities are reported to be extremely positive about the programs and the opportunities they offer to talk with teachers.

The primary value of industry site visits is considered to be the opportunity for teachers to learn about what happens at the site. In addition, however, Dr. Jacobs invited individual teachers to accompany her on "planning visits" to various industries in order to discuss with the industrialists the schedule for the site visit and to relay ideas about what the teachers would like to learn. These planning visits provided teachers with an opportunity to interact at a higher level with industry staff by offering input into the content of the site visits.

One link that has yet to be strengthened is that between the collaborative and the university community. Three mathematics professors at the University of Pittsburgh have expressed interest in collaborative participation, but Dr. Salmon-Cox is uncertain about how best to take advantage of their offer. The collaborative's orientation does not lend itself to extended involvement by the School of Education at the University of Pittsburgh. Dr. Salmon-Cox thinks there are some possibilities for collaboration with Carnegie Mellon University. Work being done by Lauren Resnick, a nationally recognized cognitive psychologist and educator, at LRDC may be relevant, but since it is still in its formative stage, it is felt that it would not be very appealing to teachers.

Some collaboration has occurred between the collaborative projects in Pittsburgh and Philadelphia. Diane Briars and Sue Stetzer gave a joint presentation at the Pennsylvania Council of Teachers of Mathematics in spring, 1987. Dr. Briars asked Ms. Stetzer for information about other professional conferences that may interest teachers. These examples illustrate that collaboration goes beyond the confines of a single site.

TEACHER PROFESSIONALISM

Pittsburgh teachers regard themselves as professionals, and the district treats them well. Superintendent Wallace provides strong, progressive leadership. Opportunities exist for teachers to engage in professional development within the district. One teacher said her eight weeks at the Schenley Teacher Center were similar to a sabbatical and made her feel important because she was treated like a professional. For some of the time, she was given responsibility to work on her own and was able to spend a week at home preparing problem-solving lessons on her own typewriter.

Teachers' salaries in Pittsburgh range from $13,000 to $39,000. Money is also available for some teachers to work on a variety of curriculum committees for a week or two in the summer.

Department heads are paid $1,200 in addition to their regular salaries and are assigned an extra free period each day to take care of department business. Teachers remain employed in a region in which many people have lost their jobs.

The teachers' union is strong and some teachers abide by the time requirements it has established; others come to school early or leave late. At Schenley, for example, the committee of teachers and administrators that is developing the school's "excellence in schools" project for the 1987-88 school year frequently meets after school, sometimes until 6 p.m. At Allderdice, one geometry teacher stayed after school to work with students who needed to make up a test or other work.

During the 1985-86 school year, teacher participation in collaborative activities was voluntary. Because teachers were reluctant to leave their classrooms, all collaborative activities were scheduled after school, on free days, or on weekends. Beginning with the 1986-87 school year, however, six mandatory inservice days, two for each of three clusters of schools, were allocated for collaborative activities. As a result, collaborative participation was notably higher during the 1986-87 school year.

The department chairs have exhibited an enhanced sense of professionalism, evident in their increased confidence and in their willingness to address substantive issues. Equally important is the district's recognition of this professionalism, evidenced by the increased level of responsibility it has assigned to the group. This group cohesion and district recognition are the results of collaborative efforts; in particular, the collaborative coordinator made initial efforts to meet with individual department chairs, and, in some cases, with entire departments to initiate activities and to lay the groundwork upon which the department chairs can build.

MATHEMATICS FOCUS

The mathematical focus of the collaborative springs from local initiatives; Dr. Diane Briars, the school district's associate director for mathematics, provides leadership in this area. She has worked hard during the year to broaden the mathematics teachers' professional perspectives. Dr. Briars also is working on a plan to train elementary school mathematics specialists during the summer so they can begin to teach math in elementary schools; the use of elementary school teachers as mathematics specialists has precedent in the use of "generalist" certified K-8 teachers as mathematics teachers in the junior highs. Such a program would have a positive impact on mathematics teaching in the elementary schools; because Dr. Briars thinks it would take too long to provide inservice to all of the teachers, the notion of using specialists has particular appeal. Scheduling, however, is viewed as a major impediment.

The collaborative's mathematics focus is directed toward innovation and progress. As a result of the collaborative, calculators have been purchased for the district's classrooms. Resource books have also been distributed to each department, including a copy of a Transition Mathematics text. Supporting teachers' attendance at professional meetings also helps to keep teachers current regarding new trends.

Six teachers were involved in a pilot test of Algebra I textbooks. For the first time, three texts were reviewed. As part of the text assessment, student achievement and attitudes are being considered.

Another aspect of the collaborative's focus involves real-world applications of mathematics. The assistant coordinator has arranged site visits for teachers at local industries and businesses, and has worked hard to ensure that the industry representatives explain how they use mathematics in the workplace. The presentations' relevancy to teachers, however, has varied from site to site. At Blue Cross, teachers were disappointed with the discussion of actuarial science as they did not feel that the program addressed the needs of graduating high school students. At Rockwell, the industrialists stressed the importance of algebra and the use of computers. Teachers did leave the presentation believing that what they teach is actually being used, although there was not much interaction between the teachers and the Rockwell staff.

In the future, the collaborative will strive to involve local universities and colleges, using their rich mathematical resources to add to the experiences of teachers.

G. Next Steps

It is impossible to predict all of next year's activities, but two projects currently in the planning stages will be important in the collaborative's efforts to institutionalize programs that will continue after the Ford Foundation's collaborative funding is exhausted.

Using already established relationships between the business and education communities, Barbara Bridge will work on intensified partnerships focused on mathematics in two high schools. The two high schools involved are part of well-established partnerships that are likely to continue for several years. In each case, Ms. Bridge and a teacher from the participating school will work with a business representative to design initiatives of particular use and interest to mathematics teachers.

As the result of a Steering Committee suggestion, the collaborative is planning a dinner series for mathematics teachers. The department chairs have strongly endorsed this idea, marking a decided change from the reaction to a similar proposal a year ago when the group felt there would be little interest among most secondary mathematics teachers. A committee of teachers is planning the series, which, it is hoped, will serve as a vehicle for convening not only secondary teachers but others in the community interested in mathematics issues. The collaborative will help identify and attract speakers and aid in the initial organization. It is anticipated that participants will pay the costs of the dinner, thereby institutionalizing a mechanism that does not require Ford Foundation support.

SUMMARY REPORT:
ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the St. Louis Urban Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term intent of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during its first year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal for funding submitted to the Ford Foundation by the Mathematics and Science Education Center, a Division of the Network for Educational Development; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; documents provided by the project staff at the Mathematics and Science Education Center; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; and four site visits by the staff of the Documentation Project.

ST. LOUIS URBAN MATHEMATICS COLLABORATIVE

A. Purpose

As stated in the funding proposal to the Ford Foundation, a document written with the active involvement of a group of secondary mathematics teachers, the goal of the St. Louis Urban Mathematics Collaborative is to foster a spirit of collaboration among St. Louis Public Schools mathematics teachers, university mathematics professors, and mathematicians from local business and industry. Teachers expect that the collaborative will:

1. open and expand lines of communication among teachers, and between teachers and various segments of the community;
2. increase teachers' knowledge of mathematics and mathematics applications;
3. garner informed input from local business and industry of the latest technological advances that employ mathematics;
4. demonstrate to students the relevance of mathematics to the work world;
5. improve teachers' instructional techniques;
6. strengthen teachers' bonds with university faculty and other related professionals, and with scientific organizations; and
7. deepen teachers' own sense of professionalism about their careers.

The collaborative's primary goals as stated in the funding proposal are:

1. Teachers will explore potential resources among businesses, industries, and universities to discover how these resources may assist them in their own professional growth and in their classroom instruction.
2. Teachers will develop, assist in developing, and implement staff training programs for themselves and for their peers.
3. Teachers will assist in improving communications and exchanges of information among all mathematics teachers within each school and across schools.

4. Teachers will promote the recognition of accomplishments and quality performance among all mathematics teachers and students.

B. Context

The population of St. Louis is approximately 431,400; the population of its entire metropolitan area exceeds 1 million. Superintendent of Schools Jerome B. Jones directs the St. Louis School District, with the help of one deputy superintendent, two associate superintendents and four assistant superintendents. Deputy Superintendent Cozy W. Marks, Jr. oversees district administrators, including all principals, while Associate Superintendent William A. Pearson oversees the district's curriculum and programs. Curriculum Director Benjamin Price and Partnership Program Director J. Wayne Walker report to William Pearson. The Assistant Superintendent in charge of high schools, Julius Dix, reports to Cozy Marks. Working knowledge of the district's administrative structure is essential in order to understand the levels that must be kept informed. Teacher surveys require the approval of both the program and the administration associate superintendents. Activities that require the school time of teachers and/or students need a minimum of six weeks to obtain the necessary administrative approval.

St. Louis County has twenty-three school districts, not including the St. Louis Public Schools. Since 1980, the St. Louis Public Schools has carried out a court-ordered desegregation busing plan, which was begun within its borders. In 1982, the plan was expanded to include the voluntary transfer of black students from the city to county school districts, and white students from the county to the city's magnet schools.

The St. Louis Public Schools is composed of 127 schools, including 22 magnet schools. Some of the magnet programs are schools within a school. During the 1986-87 school year, district enrollment totaled 48,897 students.

During 1986-87, the St. Louis Public Schools employed approximately 3,840 certified staff members. Of the 104 mathematics teachers at the secondary level, 57 were female (34 black and 23 white), and 47 were male (15 black, 28 white, and 4 of other races). Thirty-nine of these teachers held master's degrees, thirty-one held master's degrees with thirty additional hours, and thirty-four teachers held bachelor's degrees. Eighty-six of the teachers were tenured and eighteen held probationary status. In addition to mathematics teachers, there were fourteen computer science teachers, all of whom were formerly mathematics teachers in the St. Louis Public Schools. The salary schedule in 1986-87 ranged from $19,097 for a beginning teacher with a B.A. to $36,680 for a teacher with an Ed.D. or Ph.D. who had reached the top of the schedule.

The Basic Essential Skills Test (BEST TEST) is one of the standards used within the district to measure students' mathematics achievement. This objective-referenced test is mandated by the State of Missouri to assess students' competencies in reading/language arts, mathematics, and government/economics. The test is administered annually to all eighth grade students and to high school students who have not passed a given portion of the test. In 1985, 1,331 students in grades 9-12 were required to retake the mathematics portion because they had failed it in eighth grade; this was the largest number of students ever required to retake any portion of the test. The percent of students passing the BEST TEST in mathematics has increased each year. In 1986, evaluation of high school students was expanded to include the administration of the Missouri Mastery Achievement Test. This test, in addition to demanding higher levels of skill, includes geometry items. In 1987, 86 percent of the students who were administered the test passed. The district also reported in May, 1987, that the scores on the California Achievement Tests have continued to show improvement. Between 44 and 46 percent of students in each of the four high school years scored above the national norm.

The secondary schools mathematics curriculum was revised during the 1986-87 school year; the last major revision occurred in 1976. The new curriculum covers topics from remedial mathematics through calculus. Beginning with the freshman class in 1985-86, students are required to have three years of mathematics in order to graduate. A sophomore remedial course entitled "Essential Mathematics Skills" was initiated in 1982-83. In 1983-84, another remedial course was initiated for ninth or tenth graders, called General Education in Mathematics. If students have not qualified to take algebra or basic algebra (algebra at a slower reading level and with less depth), they are placed in one of the remedial courses. Placement in freshman-level courses is based on students' CAT and BEST TEST scores. Teacher recommendations were considered in setting the standards for the tests. Higher-level mathematics courses are offered throughout the district, ranging from Basic Algebra through Calculus.

While the St. Louis Public Schools is considered not to have a shortage of qualified secondary mathematics teachers, there is a shortage of teachers with certification in mathematics teaching in the middle grades. Teacher morale is declining as the result of many issues, predominant among which is a new stipulation adopted by the School Board that students' achievement on the CAT be a major component of teacher evaluation. Teachers are therefore under considerable pressure to improve students' test scores or face the possibility of receiving unsatisfactory ratings on their own records. A main reason given for this policy is the need for improvement of the quality of instruction in the St. Louis Public Schools. The effort to use tests as a tool to weed out teacher incompetence has been challenged by the teachers' union. Some teachers have expressed the view that the practice of using test scores to evaluate teachers has also resulted in an increasing reluctance on their part to participate in any activity that requires their absence from class because of the time this might detract from preparing their students for the test. The district, however, attributes improved student test scores to the introduction of more stringent accountability for staff.

With the coming of the new superintendent, Dr. Jones, in 1983, the Curriculum Division was reorganized and designed to have more than one mathematics supervisor. Under this new structure, a mathematics supervisor was first appointed in August, 1984. Since this time there have always been at least two mathematics supervisors, but there has been a turnover in the individuals filling these positions. In 1986-87, the two mathematics supervisors were Arissa Smith and Winifred Deavens.

C. Establishment of the Collaborative

The collaborative is funded through the Mathematics and Science Education Center (MSEC). The Center was formally initiated on January 29, 1986. Its Board of Directors was established in June, 1985, for the purpose of pursuing the Center's development. Judy Morton served as interim director until Dr. Paul Markovits assumed the directorship on August 18, 1986. Many of the Center's future projects may complement collaborative activities. During 1986-87, two MSEC advisory committees were formed, one for mathematics and one for science. Arissa Smith, mathematics supervisor for the St. Louis schools, serves on the Mathematics Advisory Committee. Judy Morton is an ex-officio member.

A conscious decision was made during its earliest stages that the collaborative would be planned by teachers for teachers. Thus, the planning committee that wrote the original proposal included nine teachers and the coordinator of a gifted program located in a regular high school, along with the interim director of the Center (Judy Morton), two staff members from the St. Louis Public Schools (the director of the Partnership Program and a mathematics supervisor from the Curriculum Services Division), and a mathematics coordinator from one of the St. Louis County school districts, who served as a consultant. The teachers and principal were recommended by the director of the Partnership Program and the mathematics supervisor.

The collaborative is directed by the Collaborative Council, which was established in the fall of 1986 to provide direction for the collaborative. By the end of the 1986-87 school year, the Council was comprised of ten teachers, three administrators from St. Louis Public Schools, a university mathematician, and Judy Morton, project director. The administrators are Wayne Walker, director of the Partnership Program since its inception in 1982; Arissa Smith, mathematics supervisor in the St. Louis Public Schools since 1984; and Winifred Deavens, mathematics supervisor since 1985. Ms. Morton, the collaborative director and a former secondary teacher, has consulted in educational technology and computer applications, as well as served as a project administrator. James Richmond, a high school mathematics teacher in the St. Louis Public Schools, is the on-site observer.

The staffing of the Collaborative Council with its teacher members took place over an extended period of time; the teachers were those who indicated interest in the collaborative by attending Council meetings. At the October 14, 1986, monthly mathematics department head meeting, sponsored by the school district and held at the St. Louis Science Center, the department heads were asked to encourage teachers to become involved in the collaborative and to attend the first Collaborative Council meeting on October 30. At the October 14 meeting, Judy Morton talked about the collaborative and gave each department head materials about the collaborative to distribute to each mathematics teacher in their schools. In addition, Paul Markovits talked about the Mathematics and Science Education Center and Wayne Walker talked about the Partnership Program. All secondary mathematics teachers were notified and invited to come to the first Council meeting on October 30, held at the University of Missouri-St. Louis. About twenty teachers were expected to attend. A total of six actually attended, including two mathematics teachers. The meeting was designed to provide teachers an opportunity to plan professional activities in which they would like to participate during the 1986-87 school year. At this meeting, the purpose of the collaborative was discussed, along with site visits to businesses, internships, advanced study, project and program development, a series of speakers, and a newsletter.

A second meeting of the Council was held November 19 at 3 p.m. at the Missouri Botanical Gardens. Four teachers, as well as the project director, attended. At this meeting, other potential collaborative activities were discussed, including grant-writing assistance, workshops at the Missouri State Teachers Association Teaching Academy, participation in the EQUALS Program, and participation in projects from the National Diffusion Network. From November through May, the Council met once each month.

By March, 1987, eight of ten teacher positions on the Collaborative Council were filled and interest among teachers in the two remaining positions had increased substantially. The Council, composed of the eight teachers, the two mathematics supervisors, the Partnership Program director, and the collaborative director, then invited two university professors to participate. Dr. Richard Friedlander of the University of Missouri-St. Louis accepted. In addition, a representative from the St. Louis Public Schools' division of Technology Development will begin to serve in fall, 1987. The Council will also discuss the inclusion of two business and industry representatives in fall, 1987. Council teachers have been careful to maintain a sense of group identity for the collaborative. This sense of group membership for the collaborative has required that the Council expand slowly in terms of number. However, those who did join have been very committed to the project since their initial participation. These teachers want the project to be one that addresses the specific needs of teachers in the St. Louis Public Schools. This is in contrast to other area projects, which also include teachers from the county school districts. As a result, the Council will add representatives from other sectors relatively slowly until the teacher members are more comfortable with the direction being taken by the collaborative.

In February, the meeting time for the Council was set for the second Wednesday of each month. Topics discussed by the Council at meetings throughout the spring of 1987 included grants, workshops, site visits, collaborative relationships with universities and colleges, the newsletter, and preparations for the 1987-88 Mathematics Contest and Mathematics Fair. Reactions to the Council meetings have been very positive. After one meeting, a teacher commented, "People had good ideas and everyone was informed of this meeting." Another said, "This meeting should allow teachers to get to know each other better." Winifred Deavens, Math Supervisor, noted, "I had several items to input at this meeting, and I am happy to say that they were all received and acted upon."

In addition to having a close working relationship with the Mathematics and Science Education Center and the St. Louis Public Schools, the mathematics collaborative has the support of seven corporations, three universities and colleges, and four foundations and other cultural associations.

D. Relationship with Other Local Initiatives

During the past five years, the St. Louis Public Schools has intensified its efforts to involve a variety of community sectors in improving the academic achievement of its students and the professional development of its staff. The School Partnership Program develops instructional programs to reinforce and to enrich the curriculum using the expertise of volunteers from business and industry. These multisession programs encompass and reflect the instructional goals of the teachers and demonstrate to students the work-world applications of the skills they are acquiring in school. These programs are conducted in the classroom and at different sites throughout the community.

The Mathematics and Science Education Center is responsible to its own Board for its activities. A policy board directs the Network for Education Development of which the MSEC is a division. The chairman of the MSEC Board sits on the Network Board. There also exists a Policy Board for the Cooperating School Districts, of which the Network is a division. Although subordinate boards do not need approval of higher boards for their activities, it is expected that all projects are coordinated with an overarching goal of assisting schools and districts in educating their students in the best manner possible.

E. Project Activities

The activities sponsored by the St. Louis Mathematics Collaborative during the 1986-87 school year are described in the section "Collaborative Sponsored Activities." In addition to these activities, the collaborative also promoted teacher participation in a variety of activities that were sponsored by other organizations, but were related to fulfilling the goals of the collaborative. These are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

Site Visits

In the summer, 1986, the collaborative organized site visits for teachers at three area businesses. Five teachers participated in each visit. At the morning sessions, teachers were presented information about the business, about how mathematics is used in the business, and about the mathematics prerequisites demanded of new employees. Participating businesses provided lunch for the teachers and business associates. In the afternoon, each teacher accompanied a business representative to observe the use of mathematics in the workplace.

Resource Materials

During the summer of 1986, five groups of four or five teachers each spent about thirty hours compiling resource lists. Twenty-one teachers participated. Each group was responsible for identifying resources in one of five categories: people/organizations, information exchange among schools via data communications, books and journals, videotapes and films, and computer software. The intent is to distribute this booklet of the completed lists to all mathematics teachers. The booklet was not completed during the summer of 1986 and work on it will continue during the summer of 1987.

Effective Teaching Conference

In August, 1986, the collaborative paid $100 for each of six teachers to attend an all-day conference on Effective Teaching presented by the Missouri State Teachers Association. The conference was held at the Omni International Hotel in St. Louis.

Grant-Writing Seminars

On December 3, 1986, the collaborative sponsored for secondary school mathematics teachers a grant-writing seminar held at the La Veranda Restaurant in St. Louis. Two grant programs available to teachers in the St. Louis Public Schools were discussed: The Incentives for School Excellence Program, sponsored by the State Department of Education; and Southwestern Bell Mini-Grants, sponsored in conjunction with the St. Louis School Partnership Program. Tom Prater, Assistant Director of the Missouri Facilitator Center, discussed the National Diffusion Network facility, which serves Missouri teachers who seek access to various national educational programs. Mr. Prater brought with him an extensive display of mathematics materials, books, curriculum guides, and sample proposals for the teachers to examine while he spoke. He also offered to send materials to teachers interested in using the Facilitator Center, and to return to the collaborative on a future date to spend additional time helping mathematics teachers become aware of opportunities to bring enrichment programs to St. Louis. Tom Odneal, Department of Elementary and Secondary Education for the state of Missouri, talked about how to write grants for federal funds that were available through the state department. A total of fourteen teachers attended.

A second seminar on grant writing was offered to teachers on January 21, 1987, from 3-5 p.m. at the Partnership Program Office auditorium. Presenters Tom Prater, from the Missouri Facilitator Center, and Sally Logan, of the St. Louis Science Center, informed teachers of the availability of grants and encouraged them to write proposals. Small grants for up to $250 were available from Union Electric and could be applied for through the Science Center. Teachers were also advised of the editing and typing services available to them through the Mathematics and Science Education Center. Seven teachers attended. The low turnout was attributed in part to conflicting programs in the school district.

Participants enjoyed the session, although some pointed out that the seminar's content did not match its title of "Grant Writing." The presenters talked more about available resources for grants rather than how to write a grant. Other teachers suggested that the seminar was announced too late. One teacher said, "This can be useful. Provide more time for hands-on activities with the system used. Get the date of planned workshops such as this to us well ahead of time so we can help with attendance." A second teacher commented, "[It provided] interesting information about creative writing methods, but would have been a disappointment to anyone expecting tips on grant writing. Choose the title to reflect contents of the workshop. Perhaps we should endeavor to have tentative responses from potential audience as to know how many people to expect." A third teacher said, "The Missouri Facilitator Center seems too good to be true. St. Louis teachers should use their suggested programs. Teachers who use these programs should 'show and tell.'"

After-School Social

On April 2, 1987, the St. Louis Mathematics Collaborative sponsored an after-school social get-together for all secondary school mathematics teachers at the Forest Park Hotel. The event was designed to help teachers become better acquainted and to provide them with information about the benefits of collaborative participation. Twenty-one teachers attended.

Collaborative Newsletter

The one issue of the St. Louis Collaborative Newsletter, edited by on-site observer James Richmond, was available to teachers in mid-March, 1987. One hundred-fifty copies of the newsletter were distributed among department heads at their March meeting to be given to teachers in their departments. The issue announced a contest open to all St. Louis secondary mathematics teachers to design a logo for the collaborative's newsletter. Contestants had to provide an explanation of how the logo and the name related to the focus of the collaborative. A $50 cash prize was to be awarded to the winner. Five entries were received, but the prize will not be given until a more extensive newsletter can be printed. Until this happens, articles on the collaborative are included in other regular St. Louis Public Schools publications. In addition, the minutes of each monthly Collaborative Council meeting are distributed to each mathematics teacher as well as to other school administrators. These minutes keep the teachers apprised of collaborative events and activities.

COLLABORATIVE SUPPORTED ACTIVITIES

Reception for the New Mathematics and Science Education Center Director

A reception for Dr. Paul Markovits, the newly appointed director of the Mathematics and Science Education Center, was held January 28, 1987, at the Missouri Botanical Gardens. This event was publicized by the collaborative and all mathematics teachers received a special invitation to attend. Approximately 250 people attended, including nearly thirty mathematics teachers, college professors, math-science administrators, students, friends, and members of the business community. The evening's program included brief statements about the history and purpose of the Mathematics and Science Education Center.

All those present seemed to enjoy the reception. One teacher commented, "The committee did an almost perfect job. This is an excellent time to welcome Paul and share the Center's programs." An elementary school teacher said, "It was a success as a reception. It was 'first class.' It wasn't attended by many elementary teachers. The math-science program should stress more programs on the elementary school level." An associate chemistry professor from Southern Illinois University at Edwardsville said, "We are happy that the Center is here and we welcome collaboration."

Regional Consortium for Education and Technology Conference

On February 13-14, 1987, the Regional Consortium for Education and Technology sponsored a technology conference with the theme, "Making the Connections" between education and technology, featuring keynote speaker Dr. Seymour Papert. Approximately 900 people attended the event, which was held at the Sheraton St. Louis Hotel. Many of the speakers and exhibits focused on current changes in education and technology. The on-site observer noted that many participants were actively discussing uses for computers and technology for possible adoption by their school systems. This event was publicized by the collaborative by putting a flier announcing the conference in the mailbox of each of the mathematics teachers. However, only a few teachers actually attended.

Discrete Mathematics Workshop

On March 31 and April 1, 1987, the Mathematics and Science Education Center sponsored a seminar on discrete mathematics at the facility for the Network for Education Development located on the Fontbonne College campus. The cost to participants was $45. The Civic Progress Organization paid half of the cost of the seminar for teachers who wished to attend, and the collaborative paid all but $5 of the remaining cost. The Mathematics and Science Education Center arranged to pay for a substitute teacher for those teachers who wished it.

Dan Teague and Kevin Bartkovich from the North Carolina School of Science and Mathematics presented the seminars. Approximately twenty teachers, including six or seven from the St. Louis Public Schools, attended the evening session on March 31, which was open to the public and provided a general introduction to discrete mathematics. The April 1 seminar, which ran from 8:30 a.m. to 3:30 p.m., was attended by twenty teachers, including eight from St. Louis Public Schools. In addition to reviewing various ways to teach discrete mathematics to students at all levels, the presenters discussed applications of discrete mathematics to social studies, political science, physics, and chemistry. Topics included algorithms, data analysis and model construction, applications to matrix algebra, continuous probability, recursion, recursive functions, and recursive algorithms, the relationship between discrete and continuous functions, and the use of the computer for these applications. The seminar was of value to teachers because it introduced ways to develop the problem-solving strategies students will need to solve situations they may encounter in business/industrial settings.

EQUALS Program Seminar

The Mathematics and Science Education Center sponsored a seminar on the EQUALS Program on May 1-2, 1987. The seminar followed a free introductory meeting on April 30, which was open to the public. The cost of the seminar was $60; the Civic Progress organization paid $30 for each teacher who wished to attend, and the mathematics collaborative paid $25, so the net cost to teachers was $5. The collaborative paid for eleven teachers to attend, and it publicized the seminar. Lunch was included at the day-long session May 2. Kay Gilliland and Ruth Cossey of the Equals staff at the Lawrence Hall of Science presented the seminar.

Business/School Partnership Conference

On May 12, 1987, a one-day Business/School Partnership Conference, sponsored by the Regional Consortium of Education and Technology, was held. Fourteen mathematics teachers from the St. Louis Public Schools attended and expressed appreciation for the opportunity to interact with business people. The Partnership Program Office provided for payment of ten substitute teachers for teachers wishing to go. The high schools paid for substitutes for the other four.

F. Observations

The St. Louis Urban Mathematics Collaborative has taken steps towards developing a teacher-directed collaborative by working with its Collaborative Council to generate ideas, plan activities, and address critical issues. The discussion of the collaborative's progress will focus on four major areas: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The collaborative program is founded on the premise that the opportunity exists to enhance teachers' awareness of available resources. In brief, the collaborative's intent has been to shift teachers' concept of resources provision from fulfilling a "wish list" to supporting and constructing new professional opportunities. Writing the funding proposal provided the collaborative with an opportunity to organize and clarify the philosophical premise of the project and to emphasize the focal role of teachers in long-term planning. This type of early teacher involvement is quite different from approaches taken by other collaborative projects and merits careful documentation.

Teachers play a central role in collaborative decision making. The Collaborative Council, comprised largely of teachers, has assumed responsibility for deciding the scope of collaborative activities and for planning events. Teachers' willingness to accept this level of responsibility has evolved over time, through meetings, discussions, and the gradual building of relationships among Council members. During this time, collaborative director Judy Morton assumed the role of a facilitator. She arranged for meeting sites, prepared the agenda based on teacher input, and called the meetings to order, but Ms. Morton was very careful to be sure that all decisions were made by the teachers.

Initially, teachers were not accustomed to functioning as a body or assuming responsibility for planning professional activities. The evolution of a group of independent teachers unaccustomed to such administrative responsibilities into a cohesive, active Council of decision makers required a great deal of time, energy and patience on the part of all those involved--both the collaborative and the teachers themselves. As a result, during 1986-87 only a few activities were conducted by the collaborative. Nonetheless, the successful development of the Collaborative Council can be considered a major accomplishment. One indication of this group's evolution and of its becoming more involved was the change in the agendas from a relatively short set of items to a list of important discussion topics frequently too long to be covered in a single meeting. When asked who makes the decisions for the collaborative, the teachers offered a unanimous response: "We do."

Concurrent with the evolution of the Council has been a marked change in the role of the project director. In the collaborative's early stages, the director served as an initiator (developer) with responsibility for bringing people together to write the proposal and to form the Council. The position then became that of a facilitator for the Council and involved assisting Council members to define their role and to begin making decisions. When this group began taking charge, Ms. Morton's role evolved into that of an executive administrator for the Council, in which she implements the Council's directives.

After one year of operation, the development strategy adopted by the St. Louis Mathematics Collaborative seems to be producing some results. Council teachers have begun to appreciate one another and the opportunity to interact with their peers. They have begun to feel ownership of and membership in an organization that can make things happen. They also are convinced that more teachers should share their experiences on the Council, and are planning ways to increase teacher involvement. They are beginning to become aware of the benefits of such an organization: they see that the collaborative as an organization can provide access to the district administration in a way that would be very difficult for any single teacher to attain. For example, sometimes Ms. Morton can go directly to one of the deputy or assistant superintendents to ask a question or to arrange an activity, when an individual teacher would have to go through the normal chain of command.

The mathematics collaborative has operated as a program sponsored by the Mathematics and Science Education Center (MSEC). Paul Markovits, Director of the Mathematics and Science Education Center, has contributed some input into developing the budget for 1987-88. The Center provides Ms. Morton some office space, supplies, a phone, and a copy machine. Because the development of programs for all area school districts is an MSEC goal, the collaborative's progress and its potential for expansion is of interest to Mr. Markovits. For him, the long-range future of the collaborative will involve some program in which the city and the county districts work together. As a program of the MSEC, the Collaborative provides the Center with a rich array of ideas on possible resources that could be made available through the MSEC to teachers in the greater St. Louis region. Through the collaborative, the Center has become aware of resources such as the NCSSM, EQUALS program, Family Math, the Challenge of the Unknown project, and Uri Triesman.

What appears to be different in the St. Louis Collaborative from other collaboratives is the absence of some advisory board that addresses policy issues and that will support the work of the project director. The Collaborative Council, now consisting primarily of teachers, appears to be functioning well in deciding program issues. What this committee does not provide, however, is a formal link to the upper echelon of the school district, key organizations, universities, and businesses. Such an advisory board could be helpful in resolving conflicts that may arise in getting programs approved by the system, in helping to support decisions made by the Collaborative Council, and in providing support to the project director. Other boards such as the MSEC board could serve this purpose, but it is questionable whether they could devote the necessary level of attention to the collaborative. If steps are taken toward establishing a collaborative advisory board, it will be interesting to observe how this board will relate to the existing Collaborative Council. Hopefully, an advisory board could be formed so as not to infringe upon the Council and the decision-making power of teachers.

The collaborative frequently interacts with the administrative structure of the St. Louis Public Schools. This framework must be considered when planning any activity or in making any teacher contact. The long-term development of collaborative activities must involve the school system. This cooperative effort is of primary concern in setting collaborative priorities and in designing activities that will work with the district's curriculum and staff-development divisions to more effectively support teachers in the schools.

As with each new collaborative, project management needs further definition. This process may be a challenge for the St. Louis Mathematics Collaborative in light of its emphasis on teacher involvement, interaction with the St. Louis Public Schools, and the fact that the Mathematics and Science Education Center is itself a relatively new institution.

COLLABORATION

The Collaborative Council will be expanded to include two representatives from local universities, two from businesses, one from the district's Staff Development Division, and one from the district's Technology Development Division. One immediate benefit of this expansion will be the opportunity for some teachers to collaborate with other mathematicians as they work together to develop programs. During the first year, the majority of collaboration occurred among teachers as they served on the Council. The district's mathematics teachers have the opportunity to meet together only once or twice during the year at district-wide in-service days. Council teachers have appreciated the opportunity to become acquainted with teachers from other schools and to communicate with one another regularly.

The collaborative has provided some opportunities for teachers to interact with mathematicians from universities and businesses, including the discrete mathematics seminar, the EQUALS program presented by university and college mathematicians, and the business/school partnership conference involving several representatives of both business and higher education. Summer site visits to local businesses, in which teachers shadowed corporate employees for a day, provided teachers with direct experience in the business world. These activities have fostered relationships among mathematicians from a variety of sectors. Another major influence on the collaborative's linkages with industry has been Wayne Walker's participation in project activities. Dr. Walker, director of the Partnership Program, has attended Council meetings and has served as a direct link to the business community.

The University of Missouri-St. Louis supports the collaborative and the MSEC by providing limited office space in one of its buildings on campus. This space is shared by Mr. Markovits, Ms. Morton, a part-time consultant, and one secretary. The university plans to continue its support by moving MSEC to a larger space in a building currently under construction. The collaborative also receives support from the community at large through funding provided to the MSEC by the Civic Progress Fund, which is financed by contributions from businesses.

TEACHER PROFESSIONALISM

The collaborative treats teachers as professionals. This may be especially important in light of district pressures to evaluate teachers according to student test scores, a practice that casts teachers in a defensive role. Of the eleven collaborative sites, St. Louis is the only location where teacher evaluations depend heavily on student test scores. This policy is of concern to teachers and weighs heavily on their teaching. Teachers are addressing the issue through their union.

The impact on teachers of being judged according to whether students' scores improved over last year on a test that does not measure the content they are supposed to be teaching cannot be overstated. The current evaluation standards assign to teachers less control over what is taught in their classrooms and a role that requires greater subservience to external authority. As a result, St. Louis has a core of teachers with very low morale. It will be interesting to observe how the collaborative functions within this context to achieve its goals of assisting teachers in their professional growth and of deepening their sense of professionalism about their careers.

The district offers teachers no incentive to engage in professional activities and, in fact, exerts some pressure to discourage their participation. Many teachers have reached the top of the district's pay scale so that further accumulation of continuing education credits will not increase their salaries. Teachers are allowed two to three professional days in which the district will pay for a substitute, but they are responsible for all expenses associated with attendance at a professional meeting. This, combined with a perceived need to remain in the classroom to work with students on the subjects on which they will be tested, discourages teachers from leaving school to participate in professional meetings or experiences.

Within this context, the St. Louis Mathematics Collaborative offers teachers a chance to engage in professional activities, to make decisions about the nature of these activities, and to be a part of a network that extends beyond the walls of the school to include other teachers and mathematicians in higher education and business--that is, to be treated as a professional. Council teachers are exploring ways to increase teacher involvement, and to encourage more teachers to attend professional meetings, such as the NCTM Annual Meeting in Chicago in April, 1988. Finally--and most important--Council members are interacting with their peers and sharing the ideas and experiences they have in common as mathematics teachers.

MATHEMATICS FOCUS

A particular mathematics focus has not yet emerged in the St. Louis Collaborative. While one seminar focused on discrete mathematics, other activities have been directed more generally at specific aspects of the teaching process, such as identifying available resources, learning to write grants, or attending technology conferences. Plans are underway for a mathematics fair and a mathematics contest during the 1987-88 school year. In view of the collaborative's structure, its mathematics focus will most likely emerge from the efforts of the teachers and district mathematics supervisors, with possible input from one county district mathematics supervisor who helped write the proposal. In the future, as university mathematicians become more involved, they may influence the collaborative's mathematics focus. Worthy of note is the question of whether this teacher-directed collaborative will develop a strong mathematics focus or a more general approach to mathematics education that involves other aspects of their role as teachers.

G. Next Steps

The next major step for the St. Louis Collaborative will be the further development of the teacher-run Collaborative Council and the establishment of small teams of teachers, administrators from the St. Louis Public Schools, and university and business representatives to assist the Collaborative Council. Each team will focus its efforts on a different area of collaborative involvement. For example, teams are being established to oversee business/school relationships, peer observation, seminars and conferences, an upcoming mathematics fair, and upcoming mathematics contests.

Plans for summer, 1987, and the 1987-88 school year include five one-day visits to businesses and industries, including Citicorp, McDonnell Douglas, and the local offices of the National Weather Service; a series of mathematics contests for secondary students; a mathematics fair for the district's secondary schools; three socials; and the promotion of various seminars sponsored by the Mathematics and Science Education Center. The collaborative also plans to fund two teachers' attendance at the Phillips Exeter Computer Conference, and to fund four teachers to attend the Carnegie Foundation workshops on the fourth-year curriculum developed at the North Carolina School of Science and Mathematics. The collaborative also will continue to assist teachers to attend other conferences during the year.

In addition, mathematics departments of several local universities have agreed to allow teachers to sit in on department meetings. The Collaborative Council will sponsor one evening dinner symposium in conjunction with one or several business organizations.

SUMMARY REPORT:
SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the San Diego Urban Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal for funding submitted by the San Diego Urban Mathematics Collaborative to the Ford Foundation; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; and three site visits by the staff of the Documentation Project.

SAN DIEGO URBAN MATHEMATICS COLLABORATIVE

A. Purpose

The purpose of the San Diego Urban Mathematics Collaborative is to improve the professional lives of teachers in the San Diego area by reducing their tendency to work in isolation and by increasing the contacts that foster mutual support, professional growth, and involvement with the larger professional mathematics community. The collaborative has identified two long-term goals that it would like to see adopted by the local school districts and supported by community resources. The first is to provide teachers with opportunities to continue their education either formally (i.e., through university courses) or informally (i.e., through conferences). The second goal is to foster the active participation of more teachers in the Greater San Diego Mathematics Council and to use the GSDMC as a vehicle through which teachers can organize and promote their own professional activities.

B. Context

The San Diego metropolitan area has a population of 1,862,000, of which 876,000 reside in the city. San Diego is an industrialized area that is growing rapidly; its population is expected to increase by an average of 2.3 percent annually over the next decade. Eighty percent of this growth will result from employment-related immigration. Ethnic minorities currently comprise 26 percent of San Diego County's population, and a larger proportion of the city's, including a significant undocumented Mexican population. San Diego's major economic sectors have involved tourism, manufacturing, and defense contracting. However, the San Diego business climate is attracting many new high technology companies to the area. The growth rate for new jobs, especially skilled jobs, is expected to outpace general population growth. A major challenge facing the region is the development of a labor force that can satisfy industry's needs as well as retain high technology business. This challenge has prompted an increasing interest in helping San Diego's schools to provide a contemporary education for a growing Hispanic, Asian, Pacific Islander, and black population.

The San Diego Urban Mathematics Collaborative serves mathematics teachers in the San Diego Unified School District and the Sweetwater Union High School District. During the 1986-87 school year, the collaborative focused its efforts on reaching and serving teachers in one high school and two feeder junior high or middle schools in each of the two districts.

Dr. Thomas Payzant is the superintendent of the San Diego Unified School District. As of October, 1986, district enrollment had reached 115,461. Of this total, 46 percent of the students were white, 20 percent were Hispanic, 16 percent were black, 7 percent were Filipino, 7 percent were Indo-Chinese, and 4 percent were other minorities. A total of 5,290 classroom teachers taught in the district's 107 elementary schools, 8 middle schools, 11 junior high schools, and 15 high schools.

The San Diego Unified School District's salary ladder allows teachers to earn credits for increments through in-service and university course work, as well as through professional experience. The district's maximum salary is payable to a teacher who has fifteen years of experience, plus ninety credit points, and a master's degree.

The San Diego Unified School District is facing a budget cut approaching $10 million for the 1987-88 school year. Affected areas include the special education program, gifted student classes, physical education classes, and building maintenance. No money is being allocated for salary increases, and anticipated staff reductions are expected to affect the central office mathematics department. It is also anticipated that the budget cuts will impact on the mathematics textbook adoption program for the 1987-88 school year. This financial straitening is occurring at a time when the State of California projects a reduction in education revenues for the 1987-88 school year.

The majority of instructional decisions affecting the mathematics curriculum in the San Diego Unified School District are made by Vance Mills, a mathematics/science specialist who is also a member of the collaborative's Executive Committee. Mills, with the help of a teacher committee, selects textbooks; the committee meets regularly with department chairs. Other district decisions, such as teacher transfers, are handled by the district's Education Center, which bases its decisions on teacher seniority and the requirements of individual schools.

An informational report to the school board presented the 1986-87 Scholastic Aptitude Test (SAT) scores for high school seniors. On the verbal section of the test, San Diego's scores have increased by four points since 1985-86, contrasted with a one-point drop at the national level. On the math portion, the district's scores increased by three points as compared to a one-point gain nationally.

A proposal before the San Diego School Board would require all students to take algebra and geometry for graduation. The recommendation was part of a report commissioned by the superintendent, "The Way to the Future." A number of teachers are concerned about this proposed change.

The Sweetwater Union High School District is located between the city of San Diego and the Mexican border. The district includes National City and parts of two other communities. As of October, 1986, the district's 25,045 students were distributed among seven junior high schools, two middle schools, eight high schools, and three schools targeted for specific populations, including a vocational education school, a continuing education school, and a school for the handicapped. Of the students enrolled in Sweetwater schools, 50 percent were Hispanic, 31 percent were white, 11 percent were Filipino, 4 percent were black, and 4 percent were other minorities. Currently, the dropout rate is a problem, and the district's test scores are among the lowest in the state. The Sweetwater district employs 1,049 classroom teachers.

Anthony J. Trujillo, the superintendent of the Sweetwater Union High School District, came to the district three years ago from Marin County. One of his major goals has been to improve teaching, and as a means towards this end, he regularly visits classrooms. The mathematics collaborative's efforts are consistent with Mr. Trujillo's priorities for the district.

Seventy-one mathematics teachers from six schools--a senior high school and its two feeder junior highs from the San Diego Unified School District and from the Sweetwater Unified High School District--were selected to become involved in the collaborative during its first year. The three targeted schools from the San Diego Unified School District are Samuel F. B. Morse High School, Alexander Graham Bell Junior High School, and Keiller Middle School. The three schools from the Sweetwater Unified High School District are Sweetwater High School, National City Junior High School, and Granger Junior High School. It should be noted that after the target schools had been identified, four of the six had a change in principal and the Sweetwater District Office experienced changes in its administrative staff.

Target Schools in the San Diego Unified School District

Samuel F. B. Morse High School serves a large portion of southeast San Diego; the school's Math/Science Center for Engineering and Aerospace Magnet Program also draws students from various parts of the city. The majority of the school's 2,118 students are members of minority groups. Educational Partnership Programs with Naval Air Rework Facility, General Dynamics/Convair, and San Diego City Schools Data Systems offer students hands-on avionic work and clerical experiences. Morse High School has eighteen mathematics teachers.

Enrollment at Alexander Graham Bell Junior High School totals 2,253, of which 74 percent are minorities. Although most students live in geographical proximity to the school, the Math/Science/Computer Magnet program draws students from other areas of the city. In 1984-85, Bell's language arts CTBS scores for grades seven though nine were the highest in the district, and its two mathematics CTBS scores ranked third and fourth out of twenty-two schools. Bell Junior High School has eighteen mathematics teachers.

Keiller Middle School is a Fundamental Magnet, drawing students from many parts of the San Diego metropolitan area. Keiller's curriculum emphasizes basic skills improvement. Of the school's 653 students, 70 percent are minorities. There are eight mathematics teachers at Keiller Middle School.

Target Schools in the Sweetwater Union High School District

Sweetwater High School is located in a low-income suburb of San Diego. It serves a mixed residential, commercial, and industrial community. Over 27 percent of its families receive Aid to Families with Dependent Children (AFDC). Eighty-two percent of the 1,801 students and 40 percent of the staff are of mixed ethnic minority background. Only 10 percent of students go on to college. Eighty percent of the students score below the 36th percentile on the Comprehensive Test of Basic Skills (CTBS). The majority of the eleven mathematics teachers at Sweetwater High School have been educators for more than twelve years. Their major concerns involve the lack of time to meet with peers and a need for assistance with mathematics content.

National City Junior High School in the Sweetwater School District serves several predominantly low-income neighborhoods. Twenty-seven percent of its families receive AFDC; 85 percent of its students receive free or reduced-price lunches. Of its 1,029 students, 87 percent are classified as minority students. Average student performance on the CTBS was below grade level in language and mathematics. Several of the school's seven mathematics teachers are "cross-over" teachers who are teaching under a General Teaching Credential. One concern expressed by the staff is that about 60 percent of students are unable to obtain any type of computer-use exposure outside of the school setting.

Granger Junior High School has a student population of 915, of which more than 50 percent are minorities. Approximately 59 percent of the students receive free or reduced-price lunches. On the basis of their low CTBS scores, more than 33 percent of the students are identified for Chapter I of the Elementary and Secondary Education Act supplemental programs. The majority of the seven mathematics teachers have strong mathematics backgrounds but feel they need support in developing programs that address the problems particular to their community and their students.

A rich array of resources in San Diego provides a wide variety of opportunities for improving the professional lives of area mathematics teachers. These resources include: the Center for Research in Mathematics and Science Education (CRMSE), the Greater San Diego Mathematics Council (GSDMC), the Greater San Diego Industry Education Council (GSDIEC), Partnerships in Education

(PIE), the Greater San Diego Chamber of Commerce Education Committee, the San Diego Mathematics Project, and the San Diego Mathematics Teachers Enhancement Project. Collaborative goals, long-range planning and 1986-87 activities should be viewed in this context.

The Greater San Diego Industry-Education Council (GSDIEC) includes educators, business/industry leaders, and military representatives. This council provides recognition for educators and other personnel from business and the military who devote time beyond normal job activities to exemplary educational projects.

The Partnerships in Education (PIE) group was formed by business, industry, and military representatives, and the County Office of Education to promote academic excellence. Its activities addressed the critical shortage of mathematics and science teachers by forming the Greater San Diego High Tech Industry-Education Consortium (GSDHTIEC). PIE's first project for 1986-87 was an Industry Fellow Program, involving industrial summer internships for teachers.

In addition, the Greater San Diego Chamber of Commerce Education Committee has been an active collaborative partner in reacting to the needs of the school system.

Two teacher education projects at the San Diego State University provide opportunities for teachers. The San Diego Mathematics Project is a leadership program for teachers of mathematics in grades K-12. Project participants attended an in-service during the summer of 1986 and a retreat in the fall of 1986, as well as meetings held periodically throughout the 1986-87 school year. Professor Nicholas A. Branca directs the project, which is funded by the University of California. The project was a collaboration of the university, the San Diego County Office of Education, and the Region 15 Teacher Education and Computer Center.

The San Diego Mathematics Teacher Enhancement Project has been available to mathematics teachers in grades 5-12. The "Implementing the Framework" workshop component is designed for fully certified mathematics teachers who wish to upgrade their mathematical and pedagogical knowledge and want to play a leadership role in implementing the California Mathematics Framework in their schools and districts. The "Going Beyond the Minimum" component is designed for "cross-over" or underprepared teachers of secondary, junior high, or middle school mathematics who wish to develop their mathematics background beyond the minimum required by the Commission on Teacher Credentialing. Professor Edward Silver directs the project, which is sponsored by the university, the county, and the Region 15 TEC Center.

C. Establishment of the Collaborative

The director of the San Diego Urban Mathematics Collaborative is Alma Marosz, who contributes her time and effort as an unpaid volunteer. During the 1986-87 school year, the collaborative had two project coordinators, Beth Schlesinger and Frank Holmes. Ms. Schlesinger, a mathematics teacher in San Diego since 1968, divided her time between the district (40 percent) and the collaborative (60 percent, paid out to the district). She worked directly with the targeted teachers, coordinating project activities with the mathematics education faculty. Mr. Holmes, who holds a master's degree in counseling and a doctorate of law, is employed at the School of Engineering at SDSU as Director of the Minority Engineering program, and also practices law. He is paid by the collaborative for 25 percent overload time. Mr. Holmes was responsible for several administrative details, especially as they related to the SDSU Foundation. He also was a liaison between the project staff, minority community and the site administrators at the target schools. The on-site observer is Dr. Sharon Whitehurst, the Affirmative Action Program Administrator for the San Diego City Schools. The collaborative staff also includes a part-time secretary.

While the original plan for collaborative governance had established two committees, an Advisory Committee and an Executive Committee, the structure proved to be impractical and the two committees merged in fall, 1986, to form an eighteen-member Executive Committee. Membership of the reformulated Executive Committee is comprised of the project director and coordinators, district administrators (including the mathematics specialist from each district), math educators from SDSU, and teachers from each of the six targeted schools. The committee was restricted, in part, to facilitate greater teacher involvement in policy making.

The Executive Committee, which meets once a month, advises the collaborative staff on future plans, provides feedback on activities, and offers insight into the needs of teachers. Minutes of the Executive Committee meetings are sent to the principals of the collaborative's targeted schools. During 1986-87, for example, agenda items included plans for a collaborative retreat; an invitation to Uri Treisman of the University of California-Berkeley to speak to collaborative members; future activities such as grant-writing workshops and field days; and the future of the SDUMC Project.

The Executive Committee held an end-of-the-year celebration in the form of a buffet dinner on June 18, 1987.

D. Relationship with Other Local Initiatives

A vast array of organizations and programs in the San Diego area share the collaborative's goal of improving mathematics education; the collaborative has been fortunate in that it has been able to draw from many of these.

The Greater San Diego Mathematics Council (GSDMC) is an 800-member affiliate of the National Council of Teachers of Mathematics and of the California Mathematics Council. This group is also a member of the Greater San Diego Industry-Education Council and the Greater San Diego High Tech Industry-Education Consortium. The GSDMC encourages professional growth for mathematics teachers in San Diego County by providing publications, workshops, seminars, and an annual conference. Its special events include the Elementary Mathematics Field Day, the Junior High Mathematics Field Day, the Senior High Mathematics Field Day, the Mathematics Counts Contest for seventh and eighth graders, and the Honors Mathematics Contest for senior high students.

In February, 1987, mathematics teachers from Bell and Granger Junior High Schools and Morse High School attended a two-day meeting of the Mathematics Council. A day-long program was organized at the school to engage students in useful activity while reducing the district's reliance on large numbers of substitute teachers. Bell teachers had been successful in this kind of activity in previous years, and other teachers became interested in similar programs after learning of the idea during collaborative activities.

The San Diego High Technology Industry Consortium was formed in 1986, and has hired a coordinator for the 1987-88 school year. The Consortium has started working closely with the local Technical Education Center although the Governor's decision to cease funding the TECs will forestall this relation. To date, most funding has been provided by Unisys Corporation. Twenty positions for teachers to work as Fellows in local industry were offered during 1986; eleven successful matches of teacher and corporation were made.

A local Technical Education Center has provided industry an opportunity to become involved with the schools. The San Diego High Technology Industry-Education Consortium, which includes representatives from the county schools and from industry, has been operating for a year. The consortium is an outgrowth of the California Roundtable and is dedicated to improving the quality of high school graduates in the area. The collaborative now has a staff member on the advisory committee of the consortium.

A second possible link into industrial initiatives is available through Frank Holmes' contacts with the Mathematics, Engineering, and Science Achievement (MESA) program, and the university's minority engineering program. As yet, the collaborative has no industry funding.

Through the UMC Technical Assistance Project at the Education Development Center, Inc., the collaborative learned of the interest of SIAM, the Society of Industrial and Applied Mathematicians, in working with teachers. The collaborative has not thoroughly pursued this initiative as the collaborative teachers at this stage are not yet oriented to recognizing the value of interacting with engineers. It should be noted that many junior high teachers are crossovers from other disciplines.

The levels of support extended by the San Diego Unified and the Sweetwater Union High School districts are worthy of note. Anthony Trujillo, the superintendent of the Sweetwater district, attended the collaborative's initial planning meeting. After challenging the appropriateness of teachers spending time away from their classrooms any more than was necessary, Mr. Trujillo offered financial support for activities in his district if it were clear that teachers were committing time outside school hours. He has succeeded in convincing the Sweetwater School Board to approve $15,000 for this purpose. Traditionally, teachers from Sweetwater schools have been unable to attend professional meetings; in addition to the allocated funds, Superintendent Trujillo obtained a commitment from the school board to allow teachers to take advantage of such meetings. The San Diego Unified School District did not provide funds directly but has provided release time for teachers.

E. Project Activities

The collaborative's major strategy is to promote networking among existing resources in the San Diego area rather than to create new resources; the project makes every effort to encourage teachers to take advantage of the opportunities already available to them. However, because resources and services do not always reach the mathematics teachers who need them most, the collaborative does sponsor selected activities. These are described in the section "Collaborative Sponsored Activities."

In addition, the leadership of the collaborative believes that one effective way to get mathematics teachers directly involved in professional growth is to enable as many teachers as possible to attend major mathematics conferences and workshops offered by other organizations during the school year. The collaborative sponsored teachers to attend several conferences and workshops during 1986-87. These activities are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

Wine-and-Cheese Reception

On June 5, 1986, the collaborative held a reception for the seventy-one mathematics teachers from the six target schools to enable these teachers to become acquainted before summer began. Approximately fifteen teachers attended the gathering, which was held at San Diego State University. The event was the collaborative staff's first direct contact with the teachers in the target schools.

Evening Dinner Colloquium and Social

On Monday, September 22, 1986, the collaborative sponsored an evening dinner and colloquium at the Aztec Center of San Diego State University. All seventy-one mathematics teachers from the six target schools were invited. There was no charge for the event, but participants were asked to make advance reservations. Twenty-seven people attended, including project staff and board members; this was fewer than had been anticipated.

This initial activity was designed to introduce collaborative participants to one another. The evening was intended to be both intellectually stimulating and fun. Dr. Vince Harris of the Department of Mathematical Sciences at San Diego State University spoke on "Rabbits, Rectangles, and Regular Decagons."

While they viewed the evening as a successful social event, many participants felt the program was irrelevant. One teacher said, "It was really fun. It was a good chance to meet other people involved in this type of thing. The program was not applicable but [as a former math major] it was good for me to see that kind of thing again. I really did think that the whole idea was to get us back into being mathematicians rather than into just being teachers. The excitement of mathematics needs to be brought back into teaching." Other teachers commented: "Teachers would have preferred something more applicable to the program that they are working with"; and "I thought that the materials that he talked about were way over anything for my kids. . . . it was over my head."

Many of the teachers did express an interest in the collaborative and an eagerness to see it established. They seemed particularly interested in the collaborative's commitment to helping teachers to attend professional conferences. One teacher said, "I'm waiting for something to happen. Other teachers are waiting for this thing to fit together. Teachers are waiting for directors and coordinators to decide what they want to do. Some of the things that they will do, we've not been able to do yet.

Things like financing state and national conferences. It's a Catch 22. Some of our ideas are not possible. Their ideas--no one's interested. They need to figure out what they want to do." Another said, "I'm really looking forward to the chance to go back to conferences. After Proposition 13, that was not an option anymore at my school. The announcements were informational only."

Mini-course in Discrete Mathematics

An eleven-session mini-course in discrete mathematics was sponsored by the collaborative in fall, 1986. The first session was scheduled Tuesday, October 7, at one of the six collaborative schools. Those in attendance decided to meet from 3:30 to 5:15 on ten successive Tuesday afternoons. Project Director Marosz of the Department of Mathematical Sciences of San Diego State University was the instructor; topics to be covered included logic, sets, and set theory. An invitation to join the course was sent to teachers in the six participating schools; the letter was mistakenly sent to all schools in the Sweetwater Union High School District as well. Eleven teachers enrolled, including eight from collaborative schools and three from other Sweetwater schools; five completed the course. The five teachers who completed the course earned district hurdle credit for advancement on the career ladder.

Workshop--Technology in the Classroom

On Saturday, October 11, the collaborative sponsored a day-long series of workshops entitled "Technology in the Classroom." The workshops, held at San Diego State University, were taught by faculty from SDSU and from the University of California-San Diego, staff from the TEC Center, and district teachers. The workshops featured demonstrations of Nu Math, the Symbolic Manipulator, and Electronic Blackboard, as well as hands-on experience with Logo and the Geometric Supposer, and calculator activities. A complimentary lunch was provided, and participants received a $50 stipend for full-day attendance.

Mathematics teachers from all of the target schools were invited; seventeen teachers attended. Three of the target schools were not represented, while three teachers who were not from the target schools did attend. The lower-than-anticipated attendance was attributed both to an initial lack of interest in and commitment to the collaborative and to a lack of publicity.

Workshop participants reported that the activity was very worthwhile; the sessions were good and the speakers were interesting. The teachers seemed to appreciate in particular the opportunity to see the demonstrations of the Geometric Supposer and the Symbolic Manipulator. One teacher commented, "[The workshop] helped to dissipate any fears of technology as teaching tools."

Teachers also commented on the value of interacting with one another. One teacher said that one of the best things about the workshop was "the support of the people attending and conducting the workshop with regard to implementing the ideas discussed." Another teacher requested that participants be allowed to bring guests (who would not receive the stipend) from nontarget schools.

Bell Junior High Workshop

On January 29, 1987, the collaborative sponsored an after-school workshop, "Bell Teachers Share Their Success," for all collaborative members at Bell Junior High School. The event focused on the school's success in attaining increased collegiality among teachers, high staff morale, administrators' support, dramatically improved student achievement, and an atmosphere conducive to learning. Six Bell teachers developed and presented the workshop, which was attended by seventeen other teachers. Participants were eligible for follow-up visits to Bell during the school day for observation. Although the collaborative agreed to provide personnel to release teachers for this activity, scheduling difficulties precluded follow-up visits. At the workshop, Bell teachers described the mathematics teachers' willingness to share successful class techniques with one another. One teacher commented, "I like the family attitude of the Bell staff." Another was impressed by the "cohesiveness of the department." A third mentioned that the presenters had "made some points I had never thought of."

Workshops on the Cooperative Learning Model by Uri Treisman

Dr. Uri Treisman of the University of California-Berkeley presented workshops February 19 at Morse High School and February 20 at Sweetwater High School on how to implement cooperative-learning group activities among mathematics students. Dr. Treisman demonstrated his techniques and suggested group activities in math classes throughout the day while teachers were invited to observe. After school, Dr. Treisman met with teachers and administrators to share his insights and expertise.

At Morse High School, Professor Treisman worked in the classrooms during the day and met with teachers after school. Two teachers and the vice principal from Granger Junior High School also were involved. The collaborative and the Technical Assistance Project shared the costs of Professor Treisman's visits.

One teacher commented, "I liked the intuitive approach that he used with students. He showed how you can use the discovery method to use inductive rather than the deductive method all the time." Another said, "I could see how teachers can incorporate cooperative learning type activities in their classes."

At the invitation of Granger and Sweetwater high schools, Dr. Treisman returned to work with teachers late in March. During the morning he worked with Granger mathematics teachers. He lunched with the principals of Granger and Sweetwater, and Granger's vice principal, and spent the afternoon in Sweetwater classrooms. After school, Dr. Treisman spent an hour with the entire faculty of Sweetwater High, some fifty to sixty teachers, discussing equity issues. Barbara Nelson of the Ford Foundation's Urban Mathematics Project also was present. Dr. Treisman noted that minorities were underrepresented in the school's advanced classes. The school districts paid for this visit; Dr. Frank Holmes accompanied Dr. Treisman throughout.

Grant-Writing Workshops

Grant-writing workshops were held March 17, 18, 24, and 25, 1987, at Granger Junior High. Three collaborative teachers and four non-mathematics teachers participated, an attendance rate that was lower than anticipated. Those who participated felt that the workshops were helpful, but that they should have been held earlier in the year to allow more time before deadlines for submitting the grant proposals.

One teacher said, "We came up with a grant proposal. A weakness was not knowing what the turnout was going to be [referring to the low turnout]. For us, it was wonderful. We wouldn't have done it otherwise. I'm glad it was small, it was better for us." Another teacher said, "It was very good! I learned a lot more about grant writing: references on how to do it, buzz words and key words that are expected. It was my first time at grant writing. Received some money from the TEC Center already."

One teacher from Granger Junior High School was successful in obtaining a grant from the Teacher Education and Computing (TEC) Center that provides for continued staff development plans in a project called "Technology in the Curriculum." The project will focus on problem solving, calculators, computational skills, estimation and computers in mathematics, and science content.

Collaborative Retreat

A retreat for the teachers and staff of the San Diego Urban Mathematics Collaborative was held Friday, May 8, 1987, from 4-10 p.m. at the Ramada Inn in the Old Town section of San Diego. Thirty-two teachers (almost half of the collaborative teachers) and thirteen staff members (including nonteaching Executive Committee members) attended. Participants received a $50 stipend.

The program included a two-hour discussion of the California State framework, with participants divided into junior- and senior-high school groups. Each group was presented with a fast-moving array of hands-on activities designed to implement the Framework. This discussion was followed by dinner and "barrier speaking" activities designed to encourage teachers to seek out new acquaintances and to work cooperatively. A two-hour discussion of articulation between junior and senior high schools followed, with participants divided into all-district groups.

Participants considered the retreat a success, and many reported a feeling of collegiality among the teachers. Many teachers said that the retreat was "the best activity of the year." Teachers felt that the discussion on articulation was particularly useful, though some felt that the junior high teachers did not appreciate what the senior high teachers had to say. One major issue concerned higher long-term expectations of student performance held by the junior high school teachers. One assistant principal commented, "The schools should continue to network on a regular basis."

COLLABORATIVE SUPPORTED ACTIVITIES

Greater San Diego Mathematics Council

The collaborative paid for all seventy-one mathematics teachers from the six target schools to enroll in the Greater San Diego Mathematics Council and has encouraged their active participation in the meetings and workshops sponsored by the council.

Summer Workshops

During the summer of 1986, the collaborative reserved space for teachers from the six targeted schools to attend one of two workshops at SDSU. Ten teachers, two from each school except Keiller, participated in the San Diego Mathematics Project. Another six teachers participated in the San Diego Mathematics Teacher Enhancement Project. The superintendent of the Sweetwater School District supported the event by increasing the normal stipend for participants in the San Diego Mathematics Project to the salary paid for teaching summer school.

Sweetwater High School Problem-Solving Workshop

In the summer of 1986, the principal of Sweetwater High School funded a workshop on problem solving and other related topics in response to a concern that some changes were needed in the mathematics curriculum. Three leaders were paid to conduct the workshop--Dr. Melanie Branca, Dr. Nicholas Branca, and Ms. Beth Schlesinger. Five teachers participated and were paid for attending. Three sessions of three to four hours each were conducted over a two-week period during the early part of the summer. The topics of the sessions were cooperative learning, probability and statistics, and problem solving.

Teacher Education and Computing Center Workshops

The San Diego Urban Mathematics Collaborative paid the fees for four teachers to attend the Teacher Education and Computing (TEC) Center Workshops on April 25, May 9, and May 23, 1987. Topics for the three day-long workshops were estimation, statistics and probability, and a new approach to problem solving. One workshop focused on estimation as an integral part of problem solving and the development and integration of estimation strategies. Another used the Quantitative Literacy Series from the American Statistical Association to model ways in which statistics can be integrated into the mathematics curriculum; this workshop also offered teachers hands-on experience with data analysis. The third workshop focused on modeling problem solving and its component procedures as identified in the State Framework. The workshops were well received. One teacher, who attended two of the three, commented that the workshops were worthwhile but expressed frustration that she "didn't get a chance to implement all of my ideas."

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

The collaborative, with the help of the UMC Technical Assistance Project, funded three teachers to attend the Phillips Exeter Conference on Secondary School Mathematics and Computers at the Phillips Exeter Academy in New Hampshire. The conference, which took place in June, 1987, focused on computer applications in the mathematics curriculum.

California Achievement Program Workshops

The collaborative supported teacher attendance at the local conference on the California Achievement Program, which tests mathematics achievement of students on an ongoing basis.

Attendance at Professional Meetings

California Math Council (Southern Section Conference). On November 21 and 22, 1986, the Southern Section of the California Math Council held a conference in Long Beach, California. As part of its effort to encourage teachers to establish contact with the broader professional mathematics community, the collaborative offered stipends to forty teachers to cover the conference registration fee, travel, and accommodations. Twenty-two teachers took advantage of the opportunity to attend.

Prior to the conference, the collaborative sent information about sessions and workshops to participating teachers to help them participate in the conference to their best advantage. On November 21, Beth Schlesinger and Alma Marosz hosted a wine-and-cheese gathering for San Diego conference participants; some teachers commented it was their first opportunity to socialize with peers in a long time.

The five teachers interviewed after the conference felt the event was very worthwhile. Some teachers reported they had made changes in their classrooms as a result of their conference participation. One teacher said, "Sessions on minority students in calculus grouping is important. I have done more grouping since then." Another commented, "I went to several sessions on cooperative learning. I am going to use some in my classes." Other comments stressed the value of interacting with other teachers. For example, one teacher said, "[A strength was] going together, sharing in the car, restaurant, etc. Not just the conference. We learned a lot about each other." Another said, "There were teachers right at the junior highs that I didn't know." Teachers returned from the conference with a new enthusiasm for the teaching of mathematics and for the collaborative.

Greater San Diego Mathematics Council Annual Conference. The collaborative paid the registration fees for thirty-eight teachers from the target schools to attend the annual convention of the Greater San Diego Mathematics Council on February 6 and 7, 1987, at the San Diego Convention and Performing Arts Center. The conference provided greater San Diego mathematics teachers an opportunity to enhance their mathematics skills and teaching techniques and to engage in networking. Although some teachers expressed their concern that the conference did not provide enough workshops for secondary teachers, the conference was considered to be very worthwhile by the collaborative teachers who attended. The on-site observer noted that "there is an element of comaraderie and pride among those teachers who regularly attend the conference."

One teacher said, "I learned a lot of new things to help me with my students. It helped me with creativity and showed ways to assist students with problem-solving techniques. I always look forward to attending our conference because I gain a lot from it."

Another commented, "Every time teachers get the opportunity to come together and share ideas, it's positive."

National Council of Teachers of Mathematics Annual Convention. The collaborative funded eighteen teachers to attend the National Council of Teachers of Mathematics Annual Convention in Anaheim, California, on April 8-11, 1987. In addition, the collaborative hosted a wine-and-cheese gathering for collaborative participants to give teachers from other schools and districts the opportunity to socialize. Teachers who were interviewed appreciated the collaborative's role in funding their attendance. One teacher commented, "I think that this was one way of giving us a shot in the arm. The collaborative is the nicest thing to happen at Keiller [Middle School]. That was my very first national conference." Another said, "It was fantastic. I had the opportunity to listen to people across the country and to bring some of their methods back. I learned avenues to contact other people."

Research Grants at the Center for Research in Mathematics Science and Education (CRMSE)

Several mathematics education research grants administered by the Center for Research in Mathematics and Science Education impact directly on collaborative teachers. One such NSF grant focuses on the affective factors that impact on mathematical performance in problem solving; this study will involve an interdisciplinary team to include cognitive scientists and mathematicians, mathematics education researchers, and teachers. Another research grant, designed to improve junior high students' quantitative thinking skills, is based at Keiller Middle School. Grant activities during 1986-87 included peer tutoring by students from other schools in the San Diego Unified School District (the grant's funding agency), team teaching involving school staff and SDSU faculty, and development of supplemental quantitative activities in the eighth-grade science course. More than forty activities were developed and will be evaluated during 1987. A third grant, funded by the San Diego County Teacher Education and Computer Center, also was centered at Keiller Middle School. A MacIntosh personal computer was donated and placed in a mathematics classroom. Together, the middle school teacher and the director of the grant project developed innovative ways in which the MacIntosh could be used to supplement regular classroom instruction.

F. Observations

The San Diego Urban Mathematics Collaborative has made great strides in its first year. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism and Mathematics Focus.

PROJECT MANAGEMENT

Initially, the collaborative experienced difficulty in gaining teacher acceptance, particularly in those schools in which the staff had little or no input into the initial decision to participate. To counteract teachers' initial reluctance, the collaborative staff made a concerted effort to establish direct, personal contact with school staff. During September, the director and one coordinator arranged a meeting of San Diego District mathematics teachers at one of the schools, and a meeting of the Sweetwater District teachers at the district office. They discussed collaborative objectives and asked for input. Teachers' reluctance to participate in the collaborative, however, was very disappointing.

The collaborative administration and the original Executive Committee have recognized the importance of involving teachers in all stages of the planning process. The restructuring of the Executive Committee to involve teachers in the policy and planning decisions has spawned an increased commitment; teachers are beginning to view the collaborative as something in which they have ownership rather than as an externally provided structure.

The value of teacher input was apparent at the second meeting of the reformulated Executive Committee, at which a discussion focused on a scheduled retreat. Initially, the collaborative had planned to hold a weekend retreat. But when the teacher representatives at the meeting explained that attendance would be better if the retreat were held for only one day and at a site closer to the city, plans were changed accordingly.

The reorganization of the Executive Committee is one way in which the collaborative has demonstrated that it is responsive to barriers that might have hindered its development. The collaborative is also learning to work with its participating school districts, despite differences in the way the two districts function. For example, release time for Sweetwater teachers to attend the California Mathematics Council Conference was granted by the principals; in the San Diego Unified School district, the mathematics supervisor arranged for substitutes. In Sweetwater, the collaborative has established direct contact with the superintendent. In San Diego, which is one of the largest school districts in the country, the project's contact person is Ms. Bertha O. Pendleton, deputy superintendent. The collaborative does have some direct contact with the superintendent through Dr. Whitehurst, the collaborative's on-site observer. She presides over an educators' organization, the Black Education Administrators for the San Diego Unified School District, and meets regularly with Superintendent Payzant. Dr. Frank Holmes, one of the project's two coordinators, serves on the Advisory Committee for the Education of the Black Child, a group which also meets with Mr. Payzant on a monthly basis. Beth Schlesinger, the project's second coordinator, has worked in the district for eighteen years and has established networks with the mathematics teachers and supervisors.

The collaborative has made initial contact with two local industry representatives who serve on the Educational Advisory Committee of the local chapter of American Electronics Association and who have made a commitment to assist in recruiting industry support. This effort needs to be given paramount attention over the next grant periods. A change in staff structure is being considered to facilitate that effort.

COLLABORATION

The administration of the collaborative is well grounded in the San Diego State University and the two school districts. As the spirit of collaboration develops, teachers in the target schools are learning that they can turn to the collaborative leadership and/or the staff at the TEC Center and faculty from the Department of Mathematical Sciences at San Diego State University for assistance with special projects. For example, the collaborative leaders and members of the SDSU Math Department served as role models at Career Day at Bell Junior High School in April. The collaborative staff also assisted with test preparation for the Junior High Math Field Day in early May. The Sweetwater Mathematics Department requested a workshop on problem solving; the collaborative arranged such a workshop with presenters from San Diego State University and the Teacher Education and Computing (TEC) Center.

Interaction between collaborative staff and teachers and representatives of industry, on the other hand, was very limited during most of the 1986-87 school year. During late spring, however, the director made productive contacts with industry. The collaborative now has a staff member on the advisory committee of the Greater San Diego High Tech Industry-Education Consortium and has a commitment from that group to reserve several of their Summer Fellowships (summer positions with high tech industries) for collaborative teachers. The collaborative is now working with the San Diego High-Tech Industry and Education Consortium to provide summer internships in local industries for collaborative teachers and will continue to do so with the expectation that the internship program will expand to offer more opportunities to teachers.

It is anticipated that in 1988 a co-director will be added to the staff of the collaborative project in order to enable the current director to concentrate on obtaining industry support and on organizing effective interaction between teachers and industry professionals.

TEACHER PROFESSIONALISM

Although the earliest collaborative activities were not well attended, the restructuring of the Executive Committee triggered increased teacher participation. It is assumed that the reason for this improvement was that teachers had more direct input into the planning and had "bought into" the idea of a collaborative. There was a noticeable trend over the course of the year of both increased participation in collaborative activities and generally more favorable attitudes toward the activities. During 1987-88, it is going to be important to continue to increase teacher involvement in planning collaborative activities and also in organizing activities for their departments or districts.

The degree of cohesion within each mathematics department in the target schools appears to vary greatly. The department at Bell Junior High, for example, had developed a high level of staff collegiality and a sense of mission prior to their involvement in the collaborative. This is reflected in the department's success in obtaining resources, as well as the staff's readiness to seek new avenues for and types of resources. The school, for example, has already obtained $30,000 worth of computer hardware and a bulletin board system as a result of a grant application to the Classroom Teacher Instructional Improvement Program (CTIIP). In direct contrast, another target school depended upon the visits of coordinator Frank Holmes as a reason for organizing regular meetings of its mathematics department. (It should be noted that this school had no input into its selection as a target school.) Collaborative leaders met at the school at 7 a.m. several times until the department established a pattern of regular meetings. One of the collaborative coordinators also made periodic visits to other collaborative schools during lunch to talk informally with teachers.

It is anticipated that collaborative participation will have a direct, positive effect on the mathematics departments at the collaborative schools. Some evidence of this has already been seen. During the 1986-87 school year, for example, the chair of one of the target junior high schools organized two Saturday morning in-services for his mathematics department. One of the project coordinators attended the first in-service and was impressed with the chairman's enthusiasm and the amount of material that he had prepared for his teachers. It should be noted that these were the first in-services of this kind to take place at this school in many years.

The collaborative leadership also noticed that, as the year progressed and the teachers were given more opportunities for interaction, they became more comfortable with one another and more willing to share their successes. Evidence of this was portrayed by the teachers at Bell Junior High School who volunteered to hold the workshop, "Bell Teachers Share Their Success," for collaborative teachers.

Furthermore, teachers are beginning to seek involvement in district decision making. Teachers in the Sweetwater school district were very upset with a decision made by district and school administrators, apparently without teacher input, to remove remedial courses.

MATHEMATICS FOCUS

The San Diego collaborative is based on a strong tradition in mathematics education. San Diego State University has a very active mathematical sciences faculty that has developed and implemented a number of projects for area teachers. These activities, many of which were sponsored by the Center for Research in Mathematics and Science Education, have focused on the teaching of mathematics.

The Greater San Diego Mathematics Council has a national reputation for its high level of activity. In paying council dues for teachers in the six targeted schools, the collaborative is providing a link to a larger community with a primary focus on mathematics education. The collaborative funded thirty-eight teachers to attend the council's annual conference.

The collaborative staff identified equity in the classroom as one of its critical issues. The Executive Committee invited Dr. Uri Treisman, mathematics professor at the University of California-Berkeley, to work with teachers and their high school classes and also to speak with other collaborative teachers. These sessions were held in February, 1987, at the two collaborative high schools. Dr. Treisman also returned late in March to work with the teachers and students at Granger Junior High School.

G. Next Steps

Three collaborative activities are planned for the summer of 1987: an afternoon visit to the San Diego Math Project, a visit to the project which Uri Treisman will be conducting at a school site in Orange County, and staff assistance to the Sweetwater High School teachers for workshops scheduled during the summer. In addition, the collaborative will send two teachers to the North Carolina summer workshop at NCSSM in Durham.

Collaborative expansion is one of its major goals during the next grant period. Negotiations are now underway to add three high schools to the collaborative, two in the San Diego Unified School District and one in the Sweetwater District. Teachers in these schools will become eligible to participate in collaborative activities in the fall of 1987. In the spring of 1988, some of the junior high feeder schools will be added to the collaborative, and in fall of 1988, the remainder of the feeder schools will be added.

The collaborative's plans or goals for the coming school year include:

1. Continuing a discussion of equity issues and assisting teachers and administrators in providing intervention strategies.

2. Monitoring and supporting the articulation begun this spring among teachers in each district. The collaborative also hopes to foster similar communication among teachers of subject areas and across districts, as well as to make site administrators aware of this articulation and to encourage them to assist teachers in this endeavor.

3. Encouraging teachers to assist the collaborative by conducting in-service workshops. (Exeter conferees are obligated to present workshops for the collaborative. NCSSM conferees will present workshops for the San Diego District.)

4. Recruiting retired industry people to work with teachers in their classrooms, particularly emphasizing the applications of mathematics.

5. Assisting teachers and site administrators in an ongoing discussion of the California Mathematics Framework and its implications. In particular, the collaborative will work with teachers interested in replacing remedial courses with Math A and B as described in the Framework.

6. Recruiting math faculty from SDSU and UCSD to assist the collaborative teachers who will be working with the NCSSM curriculum.

7. Continuing support for teachers to attend conferences sponsored by the Greater San Diego Mathematics Council, the California Mathematics Council, and the National Council of Teachers of Mathematics.

8. Continuing support for teachers to attend workshops such as those sponsored by Exeter, NCSSM, SDMP, etc. The collaborative will also encourage districts to provide support.

9. Including teachers in planning activities for the collaborative, possibly by forming committees to plan and organize specific events.

10. Recruiting industry people to talk to teachers about applications of mathematics.

11. Encouraging industry to support fellowships for teachers to continue their education, particularly summer fellowships.

12. Continuing to stimulate interest in teachers and administrators regarding minority underrepresentation in college preparatory math and science courses. The collaborative also plans to assist the teachers in finding and using intervention strategies.

13. Investigating the possibility of teacher exchanges. A short-term exchange between a few teachers from San Diego and Los Angeles or San Diego and San Francisco collaboratives would be a modest start.

14. Establishing a collaborative newsletter and encouraging teachers to submit articles.

SUMMARY REPORT:
SAN FRANCISCO MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the San Francisco Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the San Francisco Mathematics Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM Conference in April, 1987, in Anaheim, California; survey data provided by teachers; and two site visits by the staff of the Documentation Project.

SAN FRANCISCO MATHEMATICS COLLABORATIVE

A. Purpose

The purpose of the San Francisco Mathematics Collaborative, as stated in the original funding proposal, is to show teachers "how mathematics is imbedded in the world around us, while being sensitive to the needs and interests of the teachers involved in the program." This statement of purpose continues to provide direction for the collaborative.

Three main goals of the collaborative have been identified. The first involves teachers' professional development as mathematicians and educational leaders. The collaborative will work to develop leadership skills in teachers and department heads, provide seminars to inform teachers of new developments in discrete mathematics and research in mathematics learning, and provide opportunities for teachers to serve as mentors and to attend conferences. The collaborative's second goal is to build collegiality among teachers, and networks between teachers and other mathematics professionals. Mathematics professionals will be invited to collaborative activities, and the collaborative will continue to work closely with the Exploratorium and with other institutions. The project's third goal is to enable teachers to infuse into their instruction a sense of the imbeddedness of mathematics in the real world. The collaborative will work to develop teacher awareness of the changing world of mathematics by presenting bi-monthly seminars on topics related to discrete mathematics, providing Summer Institutes, and awarding teachers grants for classroom projects.

B. Context

The city of San Francisco, which comprises all of San Francisco County, has a population of approximately 700,000. The area is served by the San Francisco Unified School District, which has 107 schools with approximately 60,000 students enrolled in grades K through 12. More than 80 percent of district students are minorities, and English is the second language for almost half of the student population.

San Francisco has twenty-three high schools; fourteen are small, alternative schools, while nine are major high schools with enrollments ranging between 1,500 and 2,000 students. The district has 207 mathematics teachers at the high school level; of these, 105 have a college minor or major, or an advanced degree, in the subject. It is this group of 105 mathematics-related teachers that comprises the collaborative's target audience. Thirty-eight percent of these individuals are minorities; 45 percent are over 50 years old. While about 80 percent of the students take two or more years of mathematics, recent legislation mandates that all students take two years of mathematics for graduation.

A new superintendent of schools, Ramon Cortines, was appointed April 30, 1986, and took office that summer. Mr. Cortines, who was given a three-year contract, previously was superintendent of schools in San Jose and Pasadena. He appointed Linda Davis, former assistant superintendent of Pasadena, as deputy superintendent, and Carlos Cornejo, former acting superintendent in San Francisco, to direct the district's desegregation efforts. Superintendent Cortines has challenged school principals to improve students' scores on the California Assessment Program standardized tests. His goals for the 1986-87 school year were to improve student learning and achievement, and to increase parent involvement and community participation in the schools. Some of his goals were reached when twelfth grade students tested in 1986-87 scored 2.1 percent higher than they had the previous year on the California Assessment Program Mathematics test. These were the biggest gains ever obtained in one year by seniors in the district, and were the highest scores in the last decade.

In September, 1986, teachers returned to school without a labor contract. A $321.6 million budget approved by the school board did not include pay raises for teachers. The budget did include categorical funds of $32.2 million over the 1985-86 budget, allocated for the school integration fund. On October 31, 1986, teachers threatened a one-day walkout after district negotiators offered them a 1.5 percent raise, retroactive to July 1; the walkout never occurred. A second one-day walkout, scheduled for November 26, was cancelled after contract negotiations progressed. In January, city teachers ratified a three-year labor pact giving them a 4 percent retroactive pay hike, and 1.5 percent raise effective January 1, with another 1.5 percent before the end of the year contingent on the governor's signing of a key school fund bill.

The San Francisco Unified School District faced considerable pressure in budget negotiations leading up to the 1987-88 school year, with the threat of bankruptcy raised by proposed cuts in state funding. A debate continued into the summer over whether a state surplus of $1 billion should be returned as tax rebates or used to finance education.

In response to a $8.9 million budget cut for the 1987-88 school year, the San Francisco Unified School District issued layoff notices to 700 employees, including 289 long-term substitute teachers. One implication of the layoff is that class sizes will increase. The San Francisco School Board rejected Governor Deukmejian's contention that the state's schools had too many administrators and resolved to make no cuts in this area. It is estimated that deferred maintenance work needed in SFUSD schools could total as much as $400 million; this year's $320 million school budget includes $4.2 million for deferred maintenance.

One important consideration in the SFUSD budget negotiations involves the level of funding for special programs that respond to the district's large minority population. In particular, "consent decree" programs have been successful and well funded. The Phillip Burton Academic High School, the targeted consent school, ranked second of nineteen San Francisco schools on CAP results. It was named as one of the 27 outstanding schools in the country to participate in the two-year High School Futures Planning Consortium. The program, underwritten by the Association for Supervision and Curriculum Development, will eventually produce a report designed to "chart the course" toward excellence for high schools.

More stringent standards for training teachers were adopted in November, 1986, by the Commission on Teacher Credentialing, the state agency that licenses teachers. Requirements now include one semester of classroom experience prior to student teaching; placement in the upper half of the graduating class; "personal fitness," as evaluated by the student's university; and increased supervision of student teachers by college officials. The new standards are subject to review by the schools of education in the state university system.

The deputy superintendent of curriculum for SFUSD, Linda Davis, has directed the decentralization of some responsibilities to principals and teachers. Principals were instructed to visit all classrooms during the 1986-87 school year to ascertain whether adequate resources are available. Updated mathematics textbooks and instructional equipment have been purchased and will be distributed to several schools in the district. The proposed adoption of one textbook in all schools for each mathematics course has been met with a great deal of resistance from teachers.

The San Francisco Unified School District has established a program in which mentor teachers are matched with "new" teachers. New teachers are defined as long-term substitutes who have been granted probationary status; in June, 1986, the Board of Education approved nearly 200 such appointments. Mentor teachers receive an additional $4,000 per year and, in return, are expected to make presentations on teaching methods they have found effective, to be available for individual consultations with new teachers, and to make some classroom visits.

C. Development of the Collaborative

Since its establishment almost two and a half years ago, the San Francisco Mathematics Collaborative has redefined, expanded, and formalized its governing structure. The San Francisco Education Fund remains the collaborative's funding agent and the overall clearing house for activities, under the direction of Gladys Thacher. She and Andrew Bundy, Director of Development for the SFEF, oversee and administer the collaborative.

The proposal for refunding, submitted in May, 1986, reflected a reorganization of collaborative management. The responsibilities of the current project director were redistributed across two positions--a project director, who had the responsibility for coordinating teacher activities, and a director of development and community outreach. In August, 1986, Project Director Theresa Hernandez-Heinz resigned, and in September, Wandaline Perelli was hired. A mathematics teacher in San Francisco since 1961, Ms. Perelli continued to be paid by the school district, but split her time by working 60 percent with the collaborative and 40 percent teaching in the classroom. In October, 1986, Janice Toohey, a former social worker now specializing in public relations and fund raising, was appointed on a half-time basis as the director of development and community outreach. Her major responsibilities include fund raising, establishing contacts with business and industry, and informing the public about collaborative activities. Joanne Pamperin, a secondary mathematics teacher who holds a Masters of Science degree in business, is the on-site observer.

The offices of Ms. Perelli and Ms. Toohey, which are provided by the school district, are located in Parkside, a former school building that houses the district's curriculum director and K-8 mathematics supervisor. The district had a secondary mathematics supervisor in the second half of the 1986-87 school year only. Although part-time clerical help was available through funds provided by the school district and the Education Fund, this level of support proved inadequate to meet the needs of the directors.

Both the Steering Committee, the primary policy-making body of the collaborative, and the Teachers' Council provide direction for the collaborative. Steering Committee membership has fluctuated since its inception, but has now stabilized to include the executive director of the Education Fund and representatives from the Exploratorium, San Francisco State University, the University of San Francisco, San Francisco Community College, San Francisco Unified School District, and the private sector. In addition, two members of the collaborative's Teachers' Council sit on the Steering Committee, along with the collaborative's teacher coordinator and the director of development and community outreach. Peter Colby of the Dinkelspiel and Dinkelspiel law firm chaired the committee during 1986-87. He was succeeded by Henry Der, who is the Executive Director of Chinese for Affirmative Action. Both are members of the SFEF Board of Directors, and it was by virtue of this membership that they became chairs of the collaborative Steering Committee.

The Steering Committee, which meets for 90 minutes on the first Thursday of each month, develops and implements policy, monitors and evaluates collaborative activities, provides support and guidance to the directors, and participates in the design of future activities. Meeting sites rotate among the work places of the committee's members; meetings have been held at the Exploratorium, the University of San Francisco, and at the offices of General Electric and the Education Fund. Janice Toohey sets the agenda after contacting committee members to determine what they feel should be discussed. The agenda and the minutes from the previous meeting are sent to each member prior to each meeting. On average, twelve committee members attend each meeting.

The original Teachers' Council consisted of five participants from the first Summer Institute, each from a different high school. During the 1986-87 school year, monthly meetings were held, but different teachers were invited to attend each session. Each group of teachers was asked to generate ideas for activities.

During the school year, teacher attendance at the council's meetings varied from two to eight, and topics of discussion included district issues such as textbook selection and the process of hiring the Mathematics Curriculum specialist, as well as suggested improvements in collaborative programs and plans for the coming year. Uri Treisman of the University of California at Berkeley met twice with the teachers to explore possibilities for curriculum and teaching technique changes.

During spring, 1987, efforts were made to restructure the Teachers' Council by limiting membership to a single group of teachers that would meet regularly. Permanent council membership included Project Director Wandaline Perelli and teachers Theresa Hernandez-Heinz, Sam Butscher (who sits on the collaborative's Steering Committee), Dan Bennett, Susan Kelley, Steve Merlo and Karen Morgan, all of whom had been active in collaborative activities. This newly formed council met once in May, 1987, and will continue to meet on the last Thursday of each month.

The Teachers' Council is now viewed as a select group that is to generate ideas for the collaborative. This group is planning to analyze the collaborative and to evaluate the ways in which various opportunities that may arise fit into the collaborative's structure.

The Tripartite Council is another committee that supports the collaborative by providing networking and coordination among representatives of higher education, the business community and the public schools. This council was originally established as the San Francisco Consortium of Higher Education, and included eight members, one from each institution in the area. In order to strengthen the relationship between higher education and business, eight representatives of the business community were identified through the Chamber of Commerce to join the council. With the creation of the Education Fund and its work in developing collaboratives, the council membership was further increased to include eight public school representatives, including one from the TEC Center, directors of the mathematics and science collaboratives, and Education Fund administrators. With this expansion, the group became the Tripartite Council. Malcom Watts, a former member of the faculty of the San Francisco State University Medical Center, chairs the council. Its meetings are scheduled from 8 to 9:30 a.m. on the third Wednesday of each month, a time that precludes the attendance of district teachers. The Tripartite Council meetings focus primarily on reports of collaborative activities and discussion of networking efforts and ways in which business and higher education can be of help.

D. Relationship with Other Local Initiatives

The Education Fund has created a San Francisco Science Collaborative under a grant from the Carnegie Foundation. The new science collaborative, like the mathematics collaborative, has on staff a half-time project director and a half-time director of development responsible for raising funds. The directors of development for the two collaboratives work as a team with the development director for the Education Fund.

The Industry Initiatives for Science and Math Education (IISME) program, coordinated by the Lawrence Hall of Science, familiarizes teachers with science, math, and engineering jobs, and stimulates them to encourage students to pursue math and science careers. The program, now in its third year, was initiated by Bay Area companies to help address an urgent need to enhance and increase the science and mathematics education available to high school students. The program involves 50 to 100 companies and nearly 200 Bay Area teachers. Two SFUSD mathematics teachers participated during the summer, 1986, session. The collaborative provided some publicity for this initiative.

Close links between the collaborative and the Exploratorium make the appointment of a new Exploratorium director of interest. Robert White, former chair of the Department of Electrical Engineering at Stanford University, will assume the position in the summer of 1987.

E. Project Activities

During the 1986-87 school year, the San Francisco Mathematics Collaborative sponsored a variety of activities that enabled teachers to form networks with their peers and with other professionals, and to increase their awareness of the developing world of mathematics and its applications. These activities are described in the section "Collaborative Sponsored Activities." A number of activities sponsored by the San Francisco Unified School District or by other Bay Area institutions also offered significant opportunities to area mathematics teachers. The collaborative supported these related activities by publicizing the events and, in some cases, providing funds to teachers to allow them to participate. These activities are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

1986 Summer Institute

During the summer of 1986, the collaborative offered the second Summer Institute at the Exploratorium, providing stipends amounting to $1,000 per participant. The Institute consisted of two four-week sessions, June 23 through July 22, and July 28 through August 22. Six teachers who had participated in the 1985 Summer Institute and six who had not were to attend each session. The intent of this mix was to help reinforce the information presented, to encourage peer coaching, and to expand the network established at the 1985 Summer Institute. Nine returning teachers and thirteen new teachers actually attended. Teachers who attended either or both of the Summer Institutes were considered by the collaborative to be "core" teachers, as they had experienced the value of the collaborative.

The 1986 Summer Institute focused on physics and on the underlying mathematics of the Exploratorium exhibits. The program was designed to provide teachers with a personal learning experience in physics, mathematics, and human perception, using classroom discussions and exhibit exploration. Time also was provided for participant interaction.

An interactive mode of instruction was used by the Exploratorium staff to more effectively communicate ideas and to provide teachers an example of teaching interactively. This approach benefited both the Exploratorium and the teachers; in response to teachers' comments, changes were made in some exhibits to better demonstrate applications of mathematics. In recognition of this contribution, the Exploratorium offered to underwrite the stipends of the twelve returning teachers.

Asked whether the Summer Institute was worthwhile, one teacher commented, "To say 'yes' would be an understatement," and went on to expound on the "great, inspired teaching." Another teacher commented that the experience at the Exploratorium "made me feel more comfortable about being 'looser' in my class. I always had my class more tightly structured. It gave me a freedom and a confidence I didn't have before." A third teacher commented, "At the Exploratorium we were treated as first class citizens. We didn't have a report or a final exam, we just came here and learned." Some teachers suggested that the Institute would be of greater value to teachers who actually taught physics, and others suggested minor organizational changes, but teacher comments generally were very positive.

Exploratorium Follow-up Sessions to the 1986 Summer Institute

Six follow-up sessions to the 1986 Summer Institute were held on Saturday mornings during the 1986-87 school year. One session was held in the fall; the others were held during the spring semester. Teachers said the sessions were valuable in helping them to organize the information from the Summer Institute and to apply it in their lessons during the school year. One teacher who had been particularly successful in using the Exploratorium and the information from the 1986 Summer Institute was given an opportunity at one of these follow-up sessions to present her lesson plans as well as to discuss the technical aspects of handling student field trips to the Exploratorium. This presentation gave rise to greatly increased enthusiasm among teachers for the production of curriculum materials and lesson plans focusing on methods and materials from the Exploratorium.

Teachers participating in the follow-up sessions also helped to plan the 1987 Summer Institute. They decided to continue to offer a session for veteran teachers who had attended previous Institutes and to invite fewer teachers.

Independent Study in Lesson Plan Development

As a result of the enthusiasm generated by the Exploratorium follow-up sessions, in June, 1987, nine teachers began a summer-long Independent Study program in which they work closely with Tom Humphrey, the Exploratorium physics professor in charge of the follow-up sessions. The teachers are creating lesson plans for various class levels. They will test out their lesson plans with teachers from both SFUSD and other districts in a team teaching project with Dr. Tom Humphrey. In the fall of 1987, the collaborative will feature these works in a presentation for all the district mathematics teachers and curriculum people.

Dinner Lectures

A series of dinner lectures was initiated in 1985 and continued through the 1986-87 school year. Most of the lectures featured Nobel Laureates and were sponsored by Chevron U.S.A. The events' major goal was to promote collegial relationships among mathematics teachers and representatives from business and industry. As a result of these meetings, a sense of collegiality has developed among the mathematics, science, and economics teachers who attended. The collaborative is attempting to increase participation of representatives of business and industry as a means of promoting their interaction with teachers.

In light of the fact that the dinner lectures have emphasized mathematics as it models the real world and applies to other disciplines, a science teacher from each major high school in the district was invited to attend in hopes that their participation would trigger communication and exchange among teachers from these closely aligned fields.

The first dinner lecture of the 1986-87 school year was held September 25 and featured Nobel Laureate Dr. Kenneth J. Arrow, who discussed "Individual and Social Change." Approximately fifty teachers attended, as well as several Chevron executives. The lecture focused on Dr. Arrow's model of people's patterns of choice as displayed in preferences, voting, and expenditures. Some teachers seemed unprepared for the degree of detail and specificity presented in the lecture. One teacher reported appreciating the "opportunity for intellectual stimulation" and the chance to "share thoughts with renowned academicians."

A second dinner lecture, featuring Nobel Laureate Paul Berg, was held October 8. Dr. Berg discussed "Genetic Engineering's Roots," with a focus on demystifying the subject of genetic engineering in light of extensive negative media on the subject. Approximately forty-five people attended. Many teachers who attended said it was one of the most successful and well received of the Nobel Laureate dinners. The audience was very interested in the presentation and asked many questions. One teacher commented, "It proved beyond a doubt that genetics is a science and a worthwhile science that can greatly benefit human kind." Others commented, "I learned a lot about factors leading up to various diseases and what scientists are trying to do to prevent their occurrences," and "[It was] challenging and yet not above the general knowledge of the audience."

A dinner lecture on November 12 featured Nobel Laureate Arthur Schawlow of Stanford University, who spoke on "Lasers and Their Uses." The event, held at San Francisco State University, included complimentary cocktails and dinner and was hosted by Chevron U.S.A. About eighty-five people attended. Dr. Schawlow's presentation was highly descriptive and very clear; he provided many examples and a demonstration that included shooting laser beams across the room. Participants agreed that it was an entertaining evening as well as an informative one.

Another lecture, also part of the Chevron Dinner Lecture Series, was held November 20 at the McLaren Building on the University of San Francisco campus. The collaborative, the San Francisco Mathematics Teachers Association, and the San Francisco Math Leadership Project cosponsored the event. Dale Seymour, a former mathematics teacher who currently owns a publishing company specializing in supplementary mathematics programs, spoke on "Visual Thinking." Seymour also discussed developing students' conceptual skills through classroom mathematics activities, and he presented information regarding national scales of student performance in such areas as estimating fractions and percentages.

More than 200 elementary, middle and high school mathematics teachers attended. The on-site observer felt the presentation was very well received by the teachers, although the use of nontextbook-based lesson plans may meet with resistance in schools. One teacher commented that "as teachers keyed to a textbook, we often forget the broader areas of teaching how to think and how to learn."

Another dinner lecture on January 21, 1987, also part of the Nobel Dinner Lecture Series sponsored by Chevron U.S.A., featured Dr. Donald Glaser, Nobel Laureate in Physics from the University of California-Berkeley. Dr. Glaser's speech, "Visualization in Particle Physics, Genetic Engineering, and Psychophysics," included a discussion of the visual system of comprehending data quickly and accurately, and its relevance to teaching. He used the examples of the bubble chamber from particle physics and the DNA molecule from molecular biology to stress his points. About seventy-five mathematics and science teachers attended.

On February 25, 1987, a Nobel Laureate in Economics, Dr. Gerard De Breu, spoke to nearly seventy mathematics and science teachers on the subject of economic stability and the functions of prices in an economy. The dinner was well received by those teachers interviewed. One teacher said, "It is always a pleasure to meet with the teachers from the other schools at the reception and dinner," and added that it was enjoyable "to hear from an eminent authority on mathematics and economics." Another stated, "A very good talk. Many of the economic concepts are highly theoretical. It would be difficult to translate to my high school students in terms of concrete examples."

The next dinner meeting, held April 6, 1987, featured Dr. Ross Finney, Senior Lecturer in Mathematics at M.I.T. Dr. Finney spoke on "Professional Applications of High School Mathematics" before approximately eighty secondary mathematics and science teachers. In his speech, Dr. Finney noted that high school mathematics is currently being used in genetic counseling, in determining heart patients' cardiac output, and in predicting how fast a production team will build a new airplane. He commented, "Mathematicians tend to overlook elementary math. We must show kids the genuine applications of elementary mathematics."

Teachers enjoyed the evening's socializing and were interested in Dr. Finney's comments. One teacher commented, "Easy to follow. Relevant to high school subjects. Easily transferable to students."

The final dinner lecture of the 1986-87 school year was held May 5, 1987, and featured Dan Moen, chief engineer for the construction of the Golden Gate Bridge. He spoke to approximately thirty mathematics and science teachers about the design, maintenance, and history of the Golden Gate Bridge. Because of limited space available at this function, invitations were extended primarily to frequent participants in collaborative events.

The dinner was well received. One teacher commented, "Extraordinary. Dan Moen gave a very interesting talk with many interesting facts to bring to the students." A second stated, "I would have liked to have seen the 33 simultaneous equations used in the bridge design!"

In general, teachers have found the dinner lectures worthwhile, particularly as they provided an opportunity to socialize and to meet with other mathematics teachers. One teacher commented: "The best part is talking with other teachers. Last year was my first year in the public schools. The collaborative has exposed me to nearly sixty other teachers at the monthly dinners. Before, I saw only one or two other teachers. It is a wonderful opportunity that I didn't have before." Another teacher commented that it was "nice to brush with great minds." A third teacher stated that "this sort of evening not only stimulates and broadens the teacher's background of knowledge, but also enlarges his attitudes towards teaching." Another teacher noted: "This project should be continued. I find it very informative and refreshing. It adds something to the positive image of teachers in this district. So seldom are we appreciated." Science teachers have expressed gratitude for being included in the dinner lecture series. One teacher expressed concern that computer science teachers not be overlooked when extending future invitations.

Mini-Grant Program

In the fall of 1986, the Education Fund issued a request to all mathematics teachers to submit mini-grant proposals. Grants may total $1,000 for one teacher, or $2,000 for proposals submitted jointly by two teachers; General Electric provided $17,500 specifically to be granted to mathematics teachers. Teachers were asked to design a project or to request materials that would enrich their students' mathematics education. The projects' primary goals included enrichment of mathematics instruction in the public schools, evaluation of the success of each specific project funded by the Mini-Grant Program, and the dissemination of information on each project to other teachers who may be interested in duplicating the project or using it as a basis for their own projects. The grants could be used to purchase classroom supplies or audio-visual materials, or to cover other project expenses. Interested teachers were required to submit an application describing the project, its objectives and rationale, its target population, and its budget requirements. Grant recipients also were required to submit evaluations once their projects had been completed.

In order to help teachers make more effective use of the grant offer, the Education Fund sponsored proposal-writing workshops for all district mathematics teachers on October 2 and October 8, 1986. By the closing date, only three teachers had submitted proposals. Many of those who did not apply maintained that they did not have sufficient time to write a proposal. A second RFP was issued. Ms.

Perelli sent a letter, this time inviting all mathematics teachers to a proposal-writing session at her home on Saturday, November 1. As a result of the letter and Ms. Perelli's personal contacts, each of the twelve teachers who attended submitted a proposal. On November 16, the Appropriation Committee of the Education Fund met to decide which of the twenty proposals that had been submitted would be funded.

For most teachers, this was the first time they had ever prepared a grant proposal. The proposals requested funds for: after-school field trips for a mathematics club; partitions and tables for three work stations in a mathematics lab; robotics kits to enable vocational shop students to integrate their work with mathematics; art supplies to help students experience aesthetic mathematics development; a field trip to the Exploratorium; a newsletter for teachers at six necessary high schools and for refreshments when these teachers met; computer software related to mathematics; books for a resource library; an Exploratorium field trip to work with students on specific exhibits (proposed by a Summer Institute teacher); before-school time for a teacher to train students to be peer tutors; two college students to tutor students during mathematics class; and a computer for a mathematics classroom.

The Allocations Committee deliberated on the merit of each proposal. Those that were approved were considered to be well planned, to have the potential of impacting a number of students, and to have a clearly specified budget. For some proposals, the funding decision was delayed until more information could be obtained.

Twenty proposals were submitted by mathematics teachers; twelve teachers from eight high schools received grants ranging from $250 to $1,000. The grants will be used to develop a network among mathematics teachers at "small necessary high schools"; computer software; an Exploratorium field trip; materials such as books, calculators, and supplies; peer-tutor training; a Hero 2000 Robotics kit; art supplies; and equipment for a mathematics lab.

An Education Fund reception was held for recipients of mini-grants in all content areas on June 9, 1987. One hundred and twenty-five persons attended, including the teachers who received grants and their guests, and the superintendent of schools. Three mathematics teachers who had received grants were in attendance. Teachers were given a chance to meet informally with other grant recipients and to discuss the success of their projects. A greater number of mathematics mini-grants recipients attended a reporting function the previous week. At that meeting, executives from General Electric greeted the recipients and discussed their projects.

Discrete Mathematics Workshops

Three workshops on topics in discrete mathematics were offered by the San Francisco Mathematics Collaborative during spring, 1987. The sessions were limited to twenty teachers each and were filled on a first come, first served basis. A $25 stipend was available for each class attended. Thirty-four teachers participated in the series, with each of the three workshops nearly full. After each workshop, teachers and the presenter had an opportunity to interact.

Linear Programming Workshop. On March 31, 1987, a 90-minute workshop on solving two- and three-dimensional linear programming problems was given by Millianne Lehman of the University of San Francisco. Dr. Lehman is a member of the collaborative's Steering Committee.

Geometry in Discrete Mathematics. On April 28, 1987, Tom Walsh of San Francisco City College presented a workshop on geometry in discrete mathematics with topics designed to be appropriate for tenth-grade geometry classes. Teachers spent some time working problems.

The Loading Problem. On May 19, 1987, Dr. Hal Forsey of San Francisco State University presented a workshop on the "Loading Problem," which deals with minimizing the number of identical containers needed to hold a given number of objects of known sizes. The problem was used to explore the development and testing of discrete optimization algorithms. Looking for optimal solutions rather than the solution was emphasized. Teachers enjoyed the non-algebraic approaches such as trial-and-error employed in reaching an optimal solution to workshop problems. Computer simulation was used on small numbers of input, and the problems of that method for large numbers were demonstrated. It was noted that the material in this workshop would be harder to implement in an algebra classroom setting than would be the material from the linear programming workshop.

Visits by Dr. Uri Treisman

Professor Uri Treisman of the Mathematics Department at the University of California-Berkeley visited four schools, sitting in and teaching classes and providing feedback to teachers on their teaching style. Dr. Treisman also attended several meetings, working to set priorities for the mathematics collaborative's programming. Beginning in fall, 1987, Professor Treisman will work on a new Mathematics A curriculum at Mission High School with former project director Theresa Hernandez-Heinz.

Euclid's Birthday Party

On May 15, 1987, in coordination with the San Francisco Mathematics Council, mathematics teachers were invited to attend a party celebrating Euclid's birthday.

Newsletters

A decision was made to produce a collaborative newsletter for distribution to San Francisco mathematics teachers. News by Degrees will be produced under the editorship of Wandaline Perelli and Janice Toohey. It is anticipated that the first issue of the newsletter will be mailed to San Francisco mathematics teachers during the summer of 1987. This first issue will explain the collaborative's role and publicize collaborative projects and activities.

The Exponent, the newsletter of the San Francisco Mathematics Teachers Association, occasionally includes collaborative-related information. In addition, the Exploratorium's Wavelength, a newsletter of the Exploratorium Teacher Institute, publishes news about collaborative activities.

COLLABORATIVE SUPPORTED ACTIVITIES

Woodrow Wilson Foundation Statistics Workshop

The Woodrow Wilson Foundation sponsored a workshop on statistics and probability August 4 through August 9, 1986, at the Parkside Center. The collaborative promoted the activity, to which all mathematics teachers in the district were invited. Twenty-four teachers attended, including several middle school teachers. The activity's purpose was to promote classroom activities that focus on probability and statistics and to establish a broader picture of mathematics. The Teachers' Council has recommended to the Steering Committee that this workshop be repeated in summer, 1987, under the auspices of the collaborative.

Industry Initiatives for Science and Math Education Summer Internships

SFUSD teachers Joanne Pamperin and Tom Schwartz participated in the IISME Summer Internship Program. IISME seeks to familiarize teachers with jobs in science, mathematics, and engineering by having teachers work for eight weeks in specially tailored jobs in manufacturing, analysis, testing, training, and research and development. As a result of these experiences, it is hoped that teachers will encourage their students to study mathematics and science in preparation for careers in those areas. The collaborative supports the program and provides publicity to area teachers.

On June 27, 1986, an orientation was held for all teachers (called Teacher Fellows) and industry mentors participating in the IISME Summer Internship Program. Approximately eighty-five teachers and eighty-five mentors from thirty-four companies attended. Teachers and mentors were encouraged to meet weekly to discuss the teachers' industrial work experiences and ways in which students' study of mathematics and science can be affected as a result of those experiences. Teachers were encouraged to keep careful daily records of instructional concepts or ideas that might be useful in teaching and to collect tangible work-related materials. Small-group discussions were held to generate recommendations for mentors, teachers, and company coordinators, and to discuss teacher expectations for classroom transfer of the IISME experience. Participants received a summary of these discussions, including concrete suggestions about the qualifications of mathematics teachers for tasks in industry; about inviting mentors to visit classes; about communicating what students are expected to know when they apply for a job in industry; and about studying the problem of changed teaching assignments. One mentor new to the program stated that mentors from the 1985 program told him to "expect the teachers to really work."

A midsummer working meeting was held July 16, and a "wrap-up" meeting was held August 10. Approximately 100 teachers attended the midsummer meeting, which included an opportunity for participants to discuss their experiences, a speaker, and a tour of Lawrence Hall of Science. Participants' comments suggested that they were very pleased with the event and thoroughly enjoyed talking about their industry experiences with the other Teacher Fellows.

Forty teachers and four representatives from industry met on October 25 to share experiences. At the event, teachers received modems so they could communicate with one another through personal computers; most teachers seemed very excited about the possibility of being part of an electronic billboard.

On January 10, 1987, thirty-five teachers and six mentors attended the second IISME Academy Meeting at the Hewlett-Packard offices in Cupertino. The event included a discussion of employment trends in two industries (Pacific Bell and Hewlett-Packard) and their relation to student career preparation. Other issues discussed included the promotion of curricular change and alternatives, the Academy's services to Teacher Fellows, and the achievement of the Academy's objectives. Following the meeting, teachers were invited to participate in a short session on the electronic message board system. Instructions on accessing the bulletin board system were given, and future plans for the telecommunications network were discussed.

Project R-3

Prior to the collaborative's Dinner Meeting on February 25, 1987, teachers were invited to an in-service presentation on the R-3 project, sponsored by the Small Necessary High Schools Math Network. The R-3 project has developed games and computer simulations that help put school-related activities in the perspective of ultimate career choices. Each of the career-oriented games and simulations is linked directly to basic skills in reading and mathematics. A list of available games was distributed to participants.

Interschool Mathematics Curriculum Workshops

The San Francisco Unified School District and ACCESS (Alliance for Collaborative Change in Education in School Systems), cosponsored a series of three workshops during the 1986-87 school year. The events were designed to prioritize and improve the middle school and high school mathematics curriculum, and to facilitate the transition between middle school and high school mathematics. The sessions precipitated very stimulating discussions among the teachers who attended.

Light Strokes

A light show and exhibit opened at the Exploratorium on February 27, 1987. It was sponsored by the California Art Council, and all participants in the 1986 Summer Institute were invited to attend. Several collaborative teachers participated. The artist presented demonstrations of a new art form, using advanced computer graphic techniques. The exhibit was opened to the public the following day during regular Exploratorium hours.

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

Patricia Holleran, a teacher at Galileo High School, attended a six-day conference, "Technology in the Mathematics Classroom," in Exeter, New Hampshire, in June, 1986. The conference emphasized the impact and application of the computer in the curriculum. Participants received hands-on experience with computer software. Ms. Holleran's expenses to attend the conference were paid by the Technical Assistance Project at the Education Development Center.

National Council of Teachers of Mathematics Annual Convention

The San Francisco Urban Mathematics Collaborative provided support for seven teachers to attend the National Council of Teachers of Mathematics Annual Convention in Anaheim, California, in April, 1987. A greater number of collaborative teachers attended this year than last year, and teachers commented that they went as a team rather than as individuals. Of particular value were meetings with teachers from other mathematics collaboratives and with national consultants. Teachers participated in a series of forums organized by the Technical Assistance Project of the Urban Mathematics Collaboratives.

F. Observations

The San Francisco Mathematics Collaborative continued to provide teachers with interesting and challenging activities during the 1986-87 school year. However, as the year progressed, some problems in the collaborative's underlying structure became apparent. Discussion of the collaborative's progress during the year will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

Involvement in the Urban Mathematics Collaborative Project has forced the San Francisco Education Fund to redefine its role. Originally conceived of as a funding agent that would support the projects of other organizations, the Education Fund has found itself responsible for the actual operation of the San Francisco Mathematics Collaborative. In the past there has been neither the structure nor the mentality necessary to accomplish this task. Guidelines that designate areas of accountability are being developed to facilitate the Fund's more active role in the development and management of projects. Having a specific organizational structure has become increasingly important as the Fund assumes responsibility for a great number of projects, particularly those involving collaboratives in three other curriculum areas.

This shift to a more active managerial role brings with it a need to redefine the Fund's relationship to the school district and to the collaborative Steering Committee. A great deal of the authority is likely to rest with the Education Fund and its Board. The collaborative's management history should be considered in light of this context.

During its initial year (1985-86), the collaborative struggled to define the roles and relative responsibilities of the project director and the Education Fund. Theresa Hernandez-Heinz was originally hired as project director to organize collaborative activities. As the year progressed, however, more demands were made of her. By May, 1986, a decision was made to redistribute the responsibilities of the project director across two positions--one to coordinate teacher activities and one to raise funds and foster a link with the community. When Ms. Hernandez-Heinz resigned in August, 1986, she was succeeded by Wandaline Perelli, who was appointed as project director in September and assigned responsibility for coordinating teacher activities. Janice Toohey was appointed in October, 1986, as the collaborative's director of development and community outreach.

What appeared in October to be a smooth evolutionary step in the development of the collaborative's administration ran into problems as the year progressed. The difficulties that ensued highlight the problems and complexities inherent in developing a sound collaborative structure that will not only accomplish all necessary tasks, but will fit within the framework of existing organizations.

The Education Fund wanted to establish and maintain a strong link with the school district. At the same time, the district viewed the collaborative as useful in achieving its goals. The district's commitment to the collaborative was indicated by its release of Ms. Perelli to work 60 percent of her time for the collaborative and only 40 percent in the classroom while it continued to pay her full salary. The district also provided space and some clerical help at Parkside for both Ms. Perelli and Ms. Toohey.

Over the year, however, problems developed that appear to have been a direct result of a dual administrative structure in which it was difficult to determine whether the school district or the Education Fund should provide support. For example, in the absence of a district mathematics supervisor, Ms. Perelli continually received inquiries, phone calls, and mail regarding those responsibilities.

A computer provided by the district for Ms. Perelli and Ms. Toohey's use in meeting collaborative-related responsibilities (i.e., participating on the Common Ground network) was made available to them only through a time-sharing arrangement that did not allow the needed access. The clerical help supplied was shared with others in the building and did not provide reliable support, especially in the relay of telephone messages. Furthermore, the site of the directors' office away from the Education Fund offices made communication difficult. As a result of the difficult work situation, Ms. Perelli and Ms. Toohey each began to work out of their own personal offices, where each had access to a computer, with Ms. Toohey linking in to Common Ground. Both did their own clerical work or recruited temporary help. This situation hampered the operation of the collaborative, requiring that staff time be spent on routine tasks that needed immediate attention rather than on planning and thinking about the collaborative's overall focus and direction.

The lack of a clear site for the collaborative office also reflects some lack of clarity in defining the collaborative's leadership roles. During the first year of operation, during which the collaborative operated under one project director, the leadership structure was clear. Splitting the responsibility for collaborative leadership between two positions demanded a flexibility that allowed the division of responsibilities to become more distinct only as the two people in management positions became familiar enough with each other to identify each other's strengths and weaknesses. Under the process that evolved, Ms. Perelli organized activities for the teachers and Ms. Toohey made contacts with businesses and higher education institutions and raised money. Ms. Toohey soon became known as the person to contact about the mathematics collaborative. This was due, in part, to the fact that she was available to attend meetings during school hours and in part because she was paid by the Education Fund.

The budget was controlled primarily by the Education Fund administration. Ms. Perelli was provided funds for such routine expenses as mailings and costs of activities. Early on, Ms. Perelli spent her own money and requested reimbursement. This process strained Ms. Perelli's personal finances so the collaborative established its own checking account which has proved more successful. Ms. Perelli resigned as program director in May, 1987, but has indicated a desire to remain actively involved in the implementation of collaborative activities.

While the Steering Committee, the Teachers' Council, and the Tripartite Committee provided some direction, their structure did not facilitate the collaborative's development. The Steering Committee helped to plan activities, including the discrete mathematics workshops. While the structure of the original Teachers' Council, with different teachers attending each meeting, provided a chance for a variety of teachers to become involved and to generate ideas for activities, it did not provide continuity nor did it result in the development of a group that would address long-term issues. While the Tripartite Committee helped to bring people together periodically, it provided a service rather than a directive role.

At the beginning of the 1986-87 school year, the components necessary for a collaborative were present, as evidenced by the activities that were conducted, the support expressed by the different sectors in the area, and the teachers' acknowledgements of the benefits they had received from the collaborative. What was missing, however, was an overall direction and an infrastructure upon which the collaborative could build. Collaborative directors sensed this lack of a strong structure and took action in late spring. The Teachers' Council was reconstituted to consist of a constant group of teachers who could address significant issues about the collaborative. The Education Fund appointed a collaborative manager whose responsibility it was to oversee the operations of each of the Fund's four collaboratives. This person will ensure that the structure is in place, that the leadership is provided, and that continuity exists. Judith Massey Morales was appointed collaborative manager after the Fund secured a five-year, $210,000 grant from the Walter S. Johnson Foundation to develop and to test the "collaborative model." Finally, the collaborative initiated the process of hiring its third project director, who would oversee all collaborative operations. This position will be funded through the Education Fund.

The 1986-87 school year was a time of struggle within the organization of the collaborative and of dealing with the complexities of what it takes to develop a collaborative. But action taken at the end of the year suggests that the Fund has learned from its experiences and is taking strong steps to provide a solid management structure from which to build a lasting mathematics collaborative.

COLLABORATION

The San Francisco Mathematics Collaborative is an activity-oriented project that builds on strong local resources. Collaboration is viewed as the building of a strong link between the community and its teachers. In building this link, the San Francisco Mathematics Collaborative has provided teachers with out-of-school professional activities designed to increase their knowledge of mathematics applications, to create a feeling of self-importance in teachers, and to establish teachers as experts. The collaborative has made a conscious effort to translate out-of-school activities such as institutes, seminars, and workshops into classroom activities. Collaborative activities have allowed mathematics teachers to meet, to exchange information, and to begin networking.

The San Francisco Unified School District has been supportive of the project, and collaborative goals coincide with the direction in which the superintendent would like to lead the district. The arrival of a new superintendent and the establishment of new initiatives within the district have provided the collaborative with an opportunity to have real impact and to build on these initiatives. Superintendent Cortines and Deputy Superintendent for Instruction Linda Davis have attempted to provide all of the services and resources promised by the district and outlined in the collaborative's 1986 proposal, which had been negotiated before Superintendent Cortines was appointed. However, the level of administrative support the two collaborative directors received at Parkside raises some question as to the level of district resources available to the collaborative and as to whether the district's middle management is fully aware of the collaborative's potential for enhancing district programs. A considerable turnover of personnel at this level made consistent contact with the district difficult. One obvious weak link between the collaborative and the district was the absence at Steering Committee meetings of a district administrator who could have been involved in the collaborative's decision-making process.

The Steering Committee and the Tripartite Council provide an opportunity for the collaborative's director to interact with representatives of business, industry, and higher education. Janice Toohey, Director of Development and Community Outreach, is actively involved in establishing links between the collaborative and the business community. Her work will help ensure that a strong communication channel is maintained with area businesses.

This year San Francisco State University, City College, and the University of San Francisco began to take more active leadership roles in the collaborative. Professors at each of these institutions led seminars, participated in Steering Committee meetings, and provided the start of a networking and collegial atmosphere that will allow for expansion into other forms of resource sharing in the future.

All three of the collaborative's previous corporate sponsors have renewed their grants at the same levels. In addition, the collaborative has attracted the support of Wells Fargo as a new corporate sponsor and has cultivated potential corporate and foundation donors to cover the costs of future proposals.

The San Francisco Mathematics Collaborative has been very successful in bringing together representatives of all sectors. Many committed people from the business world, such as Ron Eadie from Wells Fargo, consistently attend Tripartite Council meetings and are deeply concerned about the state of education in the city. Chevron U.S.A., General Electric, and other corporations have contributed both time and money to collaborative activities. Representatives from higher education attend meetings and make available their expertise by presenting and planning workshops for teachers. The Exploratorium staff has developed a relationship with those mathematics teachers who have attended the Summer Institutes that fosters interaction and collegial support that continues throughout the school year. As one teacher noted regarding her experience with the Exploratorium, "My teaching has come alive." Interaction has increased among some teachers who have been brought together by collaborative activities. It is clear that collaboration exists in San Francisco; what needs to be faced now is expanding the number of teachers who are actively involved and raising the level of interaction among teachers and between teachers and those in business and higher education.

That the gains are not illusory can be shown in a concrete way. Despite the frustrations and difficulties of the evolution of an administrative structure, both teachers involved as coordinator/program director have, after resigning their respective positions, maintained a high level of positive involvement.

Clearly they perceive the purposes and intentions of the collaborative as both important and feasible.

TEACHER PROFESSIONALISM

While the original proposal for funding envisioned structuring the collaborative through the formation of "school site teams" which would be "catalysts for change" within the schools, the present structure is more activity-based and involves those teachers who are most interested in events away from school. This has allowed teachers from different schools to communicate with one another, but it is questionable whether a concentration of actively involved teachers at each school who can act as "catalysts for change" has actually developed. As the proposal for refunding notes, the collaborative "has been most successful in establishing collegiality and networking among teachers" and has made marked progress in teachers' development into educational leaders. Teachers are developing curricular materials independently in ways that reflect their experiences in collaborative activities.

The number of teachers involved in the collaborative has increased from approximately sixty in the spring of 1986 to 135 by June, 1987. Teachers from twenty of the district's twenty-three high schools, representing 60 percent of those who teach high school mathematics, have attended at least one activity. Twelve new teachers will be participating in the 1987 Summer Institute, bringing to thirty-six the number of teachers who have taken advantage of the Institute programs.

Teachers certainly have been aware of the collaborative's impact on their feelings of professionalism. In a time of stress in the local educational setting, the collaborative has unambiguously treated teachers as professionals. The dinner meetings, summer workshops and mini-grants have encouraged teachers to develop networks. While great strides have been made in this area, many institutional barriers have yet to be effectively overcome.

In response to direct intervention by the collaborative, mathematics teachers submitted proposals for mini-grants for the first time. Not all of the teachers were successful in their first attempts at proposal writing. In some cases, the form of the proposal, rather than the merit of the proposal itself, caused the committee to decide against funding it. The collaborative has already begun to help teachers develop the skills necessary to write successful grant proposals. Of the twenty proposals submitted by mathematics teachers in November, 1986, eleven were funded. Of these, ten were completed successfully during the year.

The Summer Institutes at the Exploratorium, which were originally planned to help teachers, resulted in a mutually beneficial relationship that may have heightened teachers' feelings of professionalism. Input on exhibits from teachers in the Summer Institute was well received by the Exploratorium staff and was incorporated in the development of mathematical exhibits. It appears that participation in the Summer Institute provided teachers with more than the opportunity to expand their knowledge base and their instructional skills; the experience offered teachers the opportunity to be treated as experts who have something valuable to offer. The extension of the Institute to include an independent study project for the veteran participants, and their intent to share the results of their additional work with other teachers, provides a graphic example of the ways in which teachers can be energized by experiences in which they are respected as having expertise.

MATHEMATICS FOCUS

The San Francisco Urban Mathematics Collaborative has taken an eclectic approach to focusing on mathematical content, an approach that has included a variety of activities. During the 1986-87 school year, teachers were offered the opportunity to attend workshops on discrete mathematics and lectures on applications of mathematics, such as the use of mathematics in building the Golden Gate Bridge. Individual teachers who received mini-grants addressed a range of content areas, from applying mathematics to robotics to mathematics in art. Those teachers who attended the Summer Institute at the Exploratorium were able to investigate applications in more detail, resulting in the writing of lesson plans on such topics as the mathematics associated with a pendulum.

The collaborative's mathematics focus essentially comes from the many resources available in San Francisco. Up to this point, the availability of resources has determined the content that will be addressed. Opportunities may exist, however, for the collaborative to take a more proactive approach. One district initiative would unify courses across the district by having all teachers of a specific course use the same textbook. This action, which will have a significant effect on the mathematics that is taught in the classrooms, may be an issue that the mathematics collaborative can influence. A second initiative, one that is imposed by the state, is the California Framework. The San Francisco Mathematics Teachers at the NCTM Annual Meeting suggested that the collaborative could be involved in implementing the Framework.

The potential exists for a strong and clear mathematics focus in San Francisco. Until now, the collaborative's effort has been directed toward offering activities and gaining exposure. But now some San Francisco teachers are beginning to talk about direction, about changing the mathematics being taught, and about what their role in the process should be. Steps taken in the Spring to stabilize the Teachers' Council may help by establishing a group to define more clearly the collaborative's mathematics focus.

G. Next Steps

The San Francisco Mathematics Collaborative will continue to pursue the original three goals of nurturing professional development, building collegiality and networks among teachers and other mathematics professionals, and infusing "real world" applications of mathematics into instruction.

In achieving these goals, the collaborative will develop the leadership skills of teachers and department heads; keep teachers informed of new developments, changes, and research in mathematics, mathematics education and cognitive sciences; provide an opportunity for teachers to serve as mentors to their peers; include mathematics professionals in activities; encourage exchange of information among teachers and other professionals; use its involvement with the Exploratorium as a model for collaborating with other institutes; and encourage experimentation and creativity in instruction.

The collaborative will continue to work with Chevron U.S.A. to provide activities for teachers and the Discrete Mathematics Workshops, initiated in 1986-87, will continue. In addition, several new activities are planned for the 1987-88 school year. These include:

1) The collaborative will offer ten San Francisco public high school mathematics teachers the opportunity to earn three upper division credits by taking the class, "Exploring Secondary Mathematics through Science." The class, taught by Robert Marcucci, will be held at the Exploratorium and will be especially suitable for teachers without a math major or minor who would like to strengthen their background. The class will begin in September, 1987, and continue through December. Tuition for the ten teachers will be paid by the collaborative.

2) The San Francisco Mathematics Collaborative and the San Francisco Unified School District will cosponsor a five-day institute on new techniques, topics, and technology in geometry. The institute will attempt to expose participants to new directions in the content and teaching of secondary school geometry. The institute will focus on three themes: the exploration of traditional geometry using investigative techniques, the study of nontraditional topics, and the application of the computer to geometry. A stipend of $200 will be available to participants.

The collaborative will work to position itself as a permanent, integral part of the community that wields influence over the quality of mathematics education in the public schools. The new project director will provide leadership and daily coordination of activities. The new collaborative manager will help to ensure direction and management for the collaborative. The director of development and community outreach will continue to aggressively seek funds from both businesses and foundations so that the resources needed to continue and to implement the collaborative's ambitious program are available. She also will continue to seek additional visibility and support from the community for collaborative activities.

SUMMARY REPORT:
TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the activities of the Twin Cities Urban Mathematics Collaborative during the 1986-87 school year. The report is intended to be both factual and interpretive. The interpretations have been made in light of the long-term goal of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts and the way in which the activities of the collaborative during the past year have evolved in order to reach that goal.

The information presented in this report came from the following sources: the proposal submitted by the Twin Cities Mathematics Urban Collaborative to the Ford Foundation for the continued funding of the collaborative; documents provided by the project staff; monthly reports from the on-site observer; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; meetings held during the annual NCTM conference in April, 1987, in Anaheim, California; survey data provided by teachers; and six site visits by the staff of the Documentation Project.

TWIN CITIES URBAN MATHEMATICS COLLABORATIVE

A. Purpose

The purpose of the Twin Cities Urban Mathematics Collaborative, as expressed in the original proposal, is "to extend the sense of professionalism among secondary school mathematics teachers, provide for their further intellectual stimulation and renewal, and establish collegial and professional relationships among the teachers and the wider mathematical community of the Twin Cities." During the first and second years of funding, the collaborative worked towards these goals, and in future years, the collaborative's efforts will be directed at refining their focus. This includes addressing issues which deal with more sophisticated areas of intellectual and political involvement, extending the involvement throughout the Twin Cities, and seeking avenues to ensure continuation of the collaborative project beyond the involvement of the Ford Foundation. Five specific steps have been identified to help the collaborative achieve its goals. They are:

1. involving teachers in activities that help them to exercise more responsibility and control over their professional lives;

2. continuing to provide a broad range of mathematical activities that encourage ongoing participation within the collaborative;

3. expanding the base and scope of industrial involvement;

4. integrating groups and organizations involved in precollege mathematics education into the collaborative; and

5. increasing the visibility and the stature of the collaborative in the Twin Cities, specifically within the school districts.

B. Context

The State of Minnesota has experienced extreme economic difficulties. In 1986, the state faced a $734 million shortfall, and a farm economy crisis has seen the value of farm land drop from $1,000 per acre in 1978 to $290 per acre in 1986. These and other economic problems have prompted the state to lower its financing of education from nearly three-quarters of the total expense to less than one-third of the cost. In 1987, basic state aid totalled $1,700 per pupil unit. The reduced state funds have placed more of the financial burden of education onto the districts. The financial problems of Minneapolis and St. Paul are compounded due to the decline in the earnings of local industry, particularly in some of the high technology industries. While local school boards do retain some capacity for increasing property taxes, the maximum levy is limited by law.

In the spring, 1987, legislative session, the funding of education in Minnesota was changed radically for the first time since 1971. The bill that was passed funded education aids at equal levels per pupil in all districts and eliminated almost all "categorical aids," i.e., those designated for a specific purpose. The legislature then added a 1 mill levy to assist Minneapolis and St. Paul with desegregation as a way to make up the budget shortfall. As a result of the legislative action, the Minneapolis Board of Education has hired legal counsel to investigate the feasibility of filing suit to force the state to pay the cost of desegregation in the major cities. If the initial investigation is positive, St. Paul is likely to join the suit. Cited as legal precedents for such action are Michigan, Ohio, and Wisconsin.

Minnesota's Postsecondary Options Enrollment Act (PSOEA) allows any eleventh or twelfth grader enrolled in a public high school in Minnesota to attend any Minnesota college (public or private), part-time or full-time, at no cost, and to receive both high school and college credit for courses taken. Costs are paid by diverting state funds from the districts to the colleges. The bill was amended in 1986 to grant high school credit only for college courses taken at district expense. If a student wishes to receive college credit, the student normally does not receive high school credit and must pay college tuition.

In other legislative action this year, a voluntary open enrollment plan was passed. Districts may voluntarily allow open enrollment, which enables but does not require students to enroll in districts other than their own, where students can enroll in any district but are not forced to do so. About 30 districts, including St. Paul and Minneapolis, were participating as of June, 1987. Both Minneapolis and St. Paul allow students to enroll in another district only if the switch does not negatively impact desegregation.

The Minneapolis and St. Paul school districts, which comprise the Twin Cities Urban Mathematics Collaborative, are similar in some regards and quite different in others. Minneapolis has seven senior high schools (grades 9 through 12) and six junior high schools (grades 7 through 8). St. Paul has six senior high schools (grades 10 through 12) and nine junior high schools (grades 7 through 9). The State of Minnesota requires junior high mathematics teachers to have secondary certification. In both districts, department chairs are selected by the teachers and can be changed annually. The department chairs determine class schedules and offerings but have little additional power. The two districts combined employ fewer than a dozen minority mathematics teachers.

St. Paul has struggled to maintain quality public education, competing with a very strong parochial school system which has, in the past, enrolled a large proportion of the district's students, thereby reducing support in the city for public education. Even though the overall student population is decreasing, the minority population is increasing. Under the leadership of Superintendent David Bennett, the St. Paul schools have begun the process of desegregation by instituting some elementary school magnet programs. The high cost of the desegregation program, which was introduced in 1985-86 and includes busing of students, appears to have been a contributing factor to the financial problems of St. Paul. Towards the end of the 1986-87 school year, the St. Paul school district was faced with a projected deficit of $1.2 million. Teachers were informed that the deficit could mean the loss of 215 jobs, including about 100 teaching positions. As the summer progressed, however, the deficit failed to materialize, relieving the need to lay off teachers.

Declining enrollment has impacted on the St. Paul school district. While the district has assured teachers that they will have jobs, it has also informed them they probably will not have a choice of assignment. A positive note is that it is anticipated that the predicted teacher shortage within the next five to ten years may be offset by the abolition of the mandatory retirement rules.

A deficit of $5.3 million was projected for the Minneapolis school district; taxpayers anticipated that the increases in local taxes and levies to cover the deficit would be the largest in recent years. The district hoped to save $2.6 million by changing school starting times, and another $500,000 by eliminating bus service for private school students outside the district. About 500 employees received layoff notices, but it was anticipated that most would be reinstated at the beginning of the 1987-88 school year. In the fall, 1987, thirteen teaching positions were lost, and six nonteaching ones gained.

Court-ordered desegregation in Minneapolis was in effect from 1973 to 1981. In 1981, the district approved a five-year plan proposed by then-newly appointed Superintendent Dr. Richard Green. This plan resulted in the closing of eighteen schools and the desegregation of all schools in the Minneapolis school district. The minority population at any one school in a given grade must fall within 15 percent of the average number of minority students enrolled in that grade in the district as a whole. In the last ten years, the percentages of minorities enrolled in the school district has jumped from 24 percent to 42 percent. Another impact of the five-year plan adopted by the Minneapolis school district has been the reassignment of teachers. Supported by the teachers' union, teachers filled the reduced number of positions by seniority. This resulted in some of the senior high school teachers, even those having as many as fourteen years of experience, being reassigned to junior high schools. The addition of the mathematics requirement, combined with the decision in

Minneapolis to staff for a six- (rather than five-) hour day in grades 9 through 12, resulted in the hiring of some new teachers in each high school during the five-year period ending in 1986.

The legislature also passed a bill that would increase the membership of the Minneapolis School Board from seven to nine if approved at a November 3 referendum. The at-large members would be replaced by six members representing different regions in the district and three at-large members.

A State Task Force of the Higher Education Coordinating Board (HECB) has recommended the adoption of a set of skills necessary for college work. The task force recommends that a statewide test in mathematics be instituted for high school juniors in order to appraise students of their strengths and weaknesses. Consideration is being given to basing the new test on the ATOMS (Advanced Testing of Mathematical Skills) Exam, which was developed and scored by the Mathematics Department at the University of Minnesota. In 1986-87, the ATOMS test was administered to 2,745 students in eighteen schools in the Twin Cities. The collaborative is considering ways to become involved in the continued development of this examination.

A $2 million project will start next year to help minority students attend college. Five hundred minority junior high school students in Minneapolis and St. Paul public schools will be identified as having the potential to attend college. The program will encourage students to complete homework assignments and to enroll in challenging classes. Teams of parents, teachers, college students and mentors will meet with students every week. The program, a venture of the University of Minnesota and the Minnesota and St. Paul schools, is the largest effort in state history to steer talented minority students to college. A $1 million donation from Super Valu stores and a matching grant from the McKnight Foundation will fund the program.

A trend toward decreasing student enrollment at the secondary levels, and increasing student enrollment at the primary levels is evident in both the Minneapolis and St. Paul school districts. The decline in the number of secondary students is expected to reach its nadir in 1990 at 3,000 below 1986-87 levels.

While St. Paul and Minneapolis have experienced a large influx of Southeast Asian immigrants, as well as an increase in other minority groups, enrollment in general in the city districts is declining. Results of a survey, to which 82 percent of the city's 79,000 homeowners responded, indicated that 17 percent plan to move out of the city and into the suburbs by 1991. Increasing concern regarding neighborhood security was the most frequent reason given for their plans to leave.

The St. Paul and Minneapolis school districts each have responded differently to graduation requirements. St. Paul follows the state requirement of one year of mathematics or one year of science in grades 10 through 12; Minneapolis has increased this requirement to one year of mathematics and one year of science. Minneapolis also has instituted a standard minimum curriculum that is supported by "benchmark" tests used to identify students for intervention classes. The University of Minnesota will be requiring three years of secondary school mathematics for admission; this may influence the graduation requirements of both school districts. While the framework exists for a strong state role, it should be noted that power still resides at the local level.

Each of the mathematics supervisors in the two districts has had health problems that have affected his level of professional activity. The Minneapolis mathematics consultant is Ross Taylor, who has authored a mathematics textbook and is well respected in the field. Taylor took a sabbatical leave during the fall of 1987. He has been very supportive of the collaborative, and has regularly held meetings of his department chairs and in-services for teachers to which the collaborative's on-site observer has been invited. Charles Lund, the assistant director for mathematics, science, and computer technology for the St. Paul schools, has returned to his position after an extended leave of absence in fall, 1986; he, too, is supportive of collaborative activities. In-services for mathematics teachers in St. Paul are less frequent than they are in Minneapolis.

The Minneapolis Business Partnership is sponsoring "Focus on Learning," an effort to encourage school administrators, parents, businesses and communities to focus additional attention on the question, "How well are our children learning?" The MBP requested proposals during spring, 1987, that described how student performance can be appropriately measured.

C. Development of the Collaborative

During the 1986-87 school year, the Twin Cities Urban Mathematics collaborative was administrated by Project Director Harvey Keynes. Professor Keynes directs special projects for the School of Mathematics of the University of Minnesota. Dr. Christopher Ennis, a lecturer and former assistant to the director of the School of Mathematics, was the project coordinator until fall, 1986, when he resigned to take a position at Carleton College in Northfield. The project director felt strongly that the coordinator should be experienced in both mathematics and administration. However, the limited budget made it very difficult to find somebody quickly who met these qualifications. The director decided not to hire a coordinator until someone could be found who possessed the desired qualifications. Instead, well-qualified people in different areas were paid to work a predetermined number of hours on specific tasks. Thus, during the year, various individuals were hired to edit the newsletter and to work as teacher coordinator. Toward the end of the year, teacher representatives in each building were identified.

Ms. Sally Sloan was appointed in December, 1986, to fill the newly created position of teacher coordinator. The position was advertised in the fall, 1986, newsletter. Ms. Sloan, a teacher at Edison High School in Minneapolis, is well known among local teachers and is aware of the current range of professional development opportunities available to teachers. As the teacher coordinator, Ms. Sloan is a member of the Teacher Advisory Committee and facilitates new activities generated by this committee and by the Steering Committee. She is also co-editor of the collaborative's newsletter. The on-site observer for the collaborative project is Gerry Sell, a parent and a former teacher who has been very active in the public schools for a number of years, including as a candidate for the School Board. Ms. Sell co-edits the collaborative newsletter and serves as project historian.

The collaborative's targeted audience includes the approximately 260 secondary certified mathematics teachers working in public, private, and parochial schools within the geographic boundaries of the cities of St. Paul and Minneapolis.

Nonteacher membership in the collaborative is somewhat loosely defined as individuals with significant professional involvement and/or interest in mathematics education in the Twin Cities. At present, approximately fifty nonteacher active members are included on the collaborative mailing list, with that number growing all the time.

Collaborative activities are overseen by a Steering Committee. A Teacher Advisory Committee also was established to serve both as a sounding board for the Steering Committee and as an advocate for ideas generated by teachers. Towards the end of the 1986-87 school year, the Steering Committee approved the appointment of individual school representatives to the collaborative. One building representative is to be identified for each public and private secondary school. These representatives, who will receive a stipend of $100, will be responsible for talking with their colleagues about collaborative activities, encouraging the mathematics teachers in their schools to read the collaborative newsletter, holding two to three meetings a year to discuss school issues, facilitating teacher discussions regarding school concerns and ideas, and helping to organize collaborative activities for teachers several times each year.

The collaborative's Steering Committee is comprised of the project director and fifteen representatives from participating organizations. The Steering Committee was established to provide the general philosophy and direction for the collaborative, as well as to develop guidelines for the implementation, modification, and evaluation of activities. In 1986-87, the committee was composed of one Minneapolis and two St. Paul teachers, the two mathematics consultants, the Director of Continuing Education of the Science Museum of Minnesota, five representatives from business/industry, and four from higher education. The director feels that the committee's broad-based membership has proven invaluable in such activities as obtaining speakers, arranging programs and other forms of in-kind support, fund raising, and, in general, working as an advocate for the collaborative. The Steering Committee meets four times during the academic year. A quorum of eight members is needed to consider an issue; group consensus is the means by which the committee approves or disapproves an item. The project director then sees to it that the broad mandates of the Steering Committee are implemented.

In 1986-87, one member of the original Steering Committee was replaced by Kenneth Vos, a mathematics education professor from St. Catherine's College in St. Paul. Professor Vos, along with Wayne Roberts of the mathematics department of Macalester College, will help strengthen the relationship between the collaborative and the area's small colleges. Both of these individuals are well known to local teachers, and their membership on the Steering Committee reinforces the impression that the collaborative does not belong solely to the University of Minnesota.

Subcommittees of the Steering Committee were formed in order to deal with specific issues. These subcommittees include: the Industrial Collaboration Committee, which is responsible for investigating links with industry; the Professionalization Subcommittee, which is charged with identifying activities and procedures to address the issue of teacher professionalism; and the Funding and Support Committee, which determines various forms of financial and nonfinancial support for current and future activities of the collaborative.

During the first year of the collaborative, the Steering Committee was relatively passive, with Harvey Keynes and Chris Ennis effectively making policy and implementing activities. During the 1986-87 school year, however, the Steering Committee began to take a greater interest in the decision-making process. At the first meeting of the 1986-87 school year, held in November, the issues of governance and leadership were raised. A teacher commented, "Wasn't that a surprise? I was all ready to drop and now it looks like the whole governance business is wide open. I think I'll stay." The meeting was considered to be successful in generating new ideas for the collaborative.

A second meeting of the Steering Committee was held on January 14, 1987, at the University of Minnesota's Vincent Hall. Eight members of the Steering Committee and one guest were present. Items of business that were addressed included:

1. A report on the ATOMS (Advanced Testing of Mathematical Skills) exam, the use of which has been supported by the collaborative.

2. Suggestions for possible model proposals for mini-grants.

3. Continuing the collaborative's participation in the NSF Teacher Renewal Project by supporting five slots for teachers in the Summer Institute.

4. Collaborative participation in the fourth-year college preparatory mathematics curriculum designed by the North Carolina School of Science and Mathematics. It was decided that funding sufficient to support up to four teachers (two each from the Minneapolis and St. Paul school districts) would be sought. Teacher selection would be made by the district math supervisors.

5. Collaborative funding for the second year was discussed extensively.

6. Ruth Anne Olson of the Private Practice Advisors gave a presentation on private practice teaching and answered the extensive questions that followed. She discussed an option in which teachers form private practices and contract their instructional services to school districts. This idea has received a considerable amount of attention in the Twin Cities. Mrs. Olson noted that this procedure defines the teachers as the autonomous professionals-in-charge. She suggested that the practice might be of particular value in mathematics education, where it could provide a way to link a variety of interests and experiences.

A third meeting of the Steering Committee was held March 11, 1987, at Vincent Hall on the University of Minnesota campus. Ten members of the Steering Committee attended, as well as Harvey Keynes and the on-site observer, Gerry Sell. At the meeting, the following topics were discussed:

1. Two candidates for participation in the NCSSM fourth-year college preparatory mathematics curriculum program were approved with the condition that both were able to attend the full session from July 5 to July 17. A third nominee would be accepted should someone apply.

2. A brief report on the January project directors' meeting in St. Louis was presented. Funding for 1987-88 was discussed. The Ford Foundation remains firm in its cash-match requirements, but it has indicated some flexibility in alternate arrangements if they should prove necessary. The current financial outlook for 1987-88 was presented; the collaborative must raise $26,000 by August, 1987, of which $10,000 to $12,000 has already been committed.

3. The Summer Institute was discussed briefly. Approximately twenty-one applications had been received. Methods to increase the number of applications were discussed.

4. The possibility of involving four teachers (two from each district) in the Mathematical Sciences Education Board

(MSEB)/Minnesota Mathematics Mobilization (M^3) hearings on the K-12 framework scheduled May 1 and 2, 1987, was discussed.

5. The Steering Committee approved the identification of individual school representatives for the collaborative. It was decided that the Teacher Advisory Board should establish a budget to be approved by the Steering Committee.

6. The Exeter Conference, to be held in the summer of 1987, was briefly discussed.

The last meeting of the Steering Committee for the 1986-87 academic year was held on May 20, 1987, in Vincent Hall at the University of Minnesota. Six members, two ex-officio members and one representative of the Special Projects Staff were present. Attendance was lower than anticipated. Among the topics of discussion were:

1. The success of the ATOMS examination, the use of which has been supported by the collaborative.

2. All collaborative schools but one have identified potential building representatives.

3. The new structure of the Twin Cities Mathematics Society was discussed. The Society would be opened to noncollaborative members, other science-related speakers would be considered, and the society would pursue a variety of dinner locations.

4. Funding for the 1987-88 budget was discussed extensively. Two recent grants from the Cray Corporation and ADC Telecommunications brought the amount pledged as of May 20, 1987, to $16,610 (of the $26,333 needed). Harvey Keynes stressed the importance of maintaining school and teacher support due to termination of support by the Ford Foundation after 1988. He also suggested that mini-grants should be used to fund creative programs as a means of encouraging continued public support for the collaborative. Plans to solicit funds from parochial and private schools were discussed. Those in attendance also discussed the need for community awareness of the collaborative and for increased support from influential people. Contact with insurance companies was discussed, and Don Boyd suggested contacting senior representatives from the Minnesota High Technology Council. Harvey Keynes provided a list of those who have been contacted for donations. He emphasized the positive movement of the collaborative.

5. Steve Watson was introduced as a part-time overall coordinator from Special Projects of the Mathematics Department for the 1987-88 school year who will be spending some of his time with the collaborative. Geneva Middleton of the Minnesota Alliance for Science was approved as a nominee to the Steering Committee.

A Teacher Advisory Committee is composed of five teachers, the project director, the project coordinator, and the project historian. Two members of the Teacher Advisory Committee also sit on the Steering Committee, serving as liaisons between the two. The Teacher Advisory Committee advises the Steering Committee on issues related to teachers' role in the collaborative and is an advocate for teachers' ideas. It is viewed as a sounding board for new programmatic ideas or directions for the collaborative and a means by which teachers can suggest specific directions for implementation. The collaborative's ultimate organizational goal is that the Teacher Advisory Committee will suggest new ideas to the Steering Committee and will implement those ideas that have been approved in principle by the Steering Committee. Although the advisory committee had planned to meet following each Steering Committee meeting, the committee was relatively inactive during its first year, 1985-86.

In fall, 1986, the five teachers on the Teacher Advisory Committee were asked whether they wished to continue to serve on the committee. Two teachers who resigned because of other commitments were replaced by two junior high teachers who had attended the 1986 Summer Institute and who had expressed interest in serving on the committee. The teacher coordinator, Sally Sloan, also became a member of the committee. During the early part of the 1986-87 school year, the functions and responsibilities of the Teacher Advisory Committee as well as its relation to the Steering Committee were further clarified and the composition of the TAC changed. As a result, the TAC appeared to be ready to accept more responsibility.

The Teacher Advisory Committee met three times during the 1986-87 school year. The first meeting was held January 19, 1987, at the University of Minnesota's Vincent Hall. Six members attended. Items discussed included:

1. A brief presentation was given on the ATOMS exam and the status of the mini-grants. The committee discussed the possibility of the collaborative developing a version of the ATOMS examination to screen for Geometry among students who have completed Algebra I.

2. The Teacher Advisory Committee agreed to the collaborative's participation in the NCSSM program for the fourth-year college preparation class. It was agreed that only teachers from the public school districts would be eligible for nomination, due to the requirement that the teachers who attend will have to provide in-service and hold workshops for public school teachers. An application deadline of February 16, 1987, was set, with the final decision to be made by the district mathematics coordinators by March 2, 1987.

3. The Summer 1987 NSF courses were discussed. Wayne Roberts presented his proposal for a course in number theory for the Summer Institute.

The committee also discussed future sites for the TCMS meetings, budget problems, mailing a brochure regarding women in mathematics, and a survey to be mailed to the membership about the TCMS meeting.

The second Teacher Advisory Group meeting was held March 9, 1987, at Vincent Hall on the University of Minnesota campus. Eight members of the Teacher Advisory Group attended. At the meeting, several major topics were discussed:

1. Sally Sloan, Marlys Henke and Rich Dehlinger reported on their conversations with Mark Driscoll of the Technical Assistance Project concerning a possible Twin Cities collaborative leadership training session.

2. The lack of applicants to the 1987 Summer Institute was discussed. Only sixteen applications had been received as of March 9. A variety of ways to contact interested teachers were discussed and planned.

3. The Advisory Committee discussed the possibility of appointing individual school representatives for the collaborative. A survey conducted by teacher coordinator Sally Sloan indicated that such a program would be effective and would receive wide support from teachers.

4. The possibility of involving four teachers (two from each district) in the upcoming Mathematical Sciences Education Board (MSEB)/Minnesota Mathematics Mobilization (M^3) hearings on the K-12 framework was discussed.

Finally, several minor items, including a collaborative computer network, the summer 1987 Exeter conference, and Sally Sloan's position as collaborative representative at the April NCTM meeting in Anaheim were discussed.

Comments from the teachers who attended the meeting indicated that they feel the meetings are worthwhile in that they provide an opportunity for teachers to get together and talk to each other. However, there still appears to be some question as to the advisory committee's relationship to the Steering Committee.

The third and last Teacher Advisory Committee meeting for the 1986-87 school year was held May 18, 1987, at Vincent Hall on the University of Minnesota campus. Six members were present. Major topics of discussion coincided with those of the Steering Committee on the same date. They included the ATOMS examination, the building representatives, the Mathematics Society dinners, and the 1987-88 budget.

The TAC decided that the Mathematics Society dinners would again be held at Macalester College during 1986-87, but that other sites would be sought for future use. A subcommittee of the TAC will help Wayne Roberts coordinate the Math Society during 1987-88. It also agreed to help identify sources of funds from within the districts. The possibility of having grant money available to (i.e., as in the case of the Junior and Senior High Math Leagues) and administered by the collaborative was discussed. A grant of $500 to $1,000 from the Minneapolis-St. Paul Archdiocese will be explored. A letter asking for financial support from private schools will be written and distributed.

Toward the end of the 1986-87 school year, building representatives were identified for each public and private secondary school in the collaborative area. The Steering Committee agreed to provide each representative with a stipend of $100. The total cost of the building representatives program will be $4,300.

The thirty-two building representatives will meet with a three-member subcommittee of the Teacher Advisory Committee, consisting of the teacher coordinator (Sally Sloan), one junior high and one senior high teacher (Jon Fisk and Marlys Henke). The first meeting will be scheduled for mid-September. At this meeting, background issues will be presented and general tasks discussed. One possible task would be identification of speakers and programs for the Mathematics Society.

Collaborative funding in 1986-87 required a 25 percent match from local sources. The collaborative chose to divide the required $15,000 equally among three major groups of sponsoring organizations: universities/colleges, school districts, and private corporations. Each school district also agreed to provide 32.8 teacher release days during the year. In addition to the funds solicited from the three groups of sponsoring organizations, it is estimated that $300 will be raised from the $2 registration fee teachers pay to attend collaborative-sponsored dinners.

The collaborative monitors its activities through surveys, questionnaires, and the Teacher Advisory Council. Information is collected from participants at collaborative activities, as well as in response to the newsletter. Teachers have been polled on such diverse issues as whether to offer a problem-solving Summer Institute that emphasizes junior high, and whether a small registration fee at dinner meetings would substantially affect attendance. Polling of teachers about important activities and issues will continue as a means of maintaining teacher influence on the nature of the collaborative's direction.

D. Relationship with Other Local Initiatives

Because of its close association with the University of Minnesota, the collaborative draws upon a wide variety of mathematical resources. In addition to its collaborative work, the School of Mathematics is involved with the Talented Youth Mathematics Project, the Actuarial Science Program, the NSF Teacher Renewal project, and the Minnesota Mathematics Mobilization (M^3). The university also provides the collaborative with a link to the national mathematical community and gives the collaborative access to visiting scholars such as Uri Treisman of the University of California-Berkeley, who consulted for the 1985 Summer Institute.

The School of Mathematics programs most related to collaborative efforts are the NSF Teacher Renewal project and the Minnesota Mathematics Mobilization (M^3). The NSF Teacher Renewal project, initiated in the summer of 1986 under the directorship of Harvey Keynes, sponsors a Summer Institute on mathematical topics, and follow-up seminars during the academic year for selected Minnesota secondary teachers. This Institute was modeled after one sponsored by the collaborative during the summer of 1985. Of the 105 teachers in the 1986 NSF Institute, four had participated in the 1985 TCUMC Summer Institute, and thirteen were collaborative members. Participation of five teachers was funded by the collaborative. The Institute helped foster a close bond among collaborative members who have attended, and information continued to circulate within the group during the academic year. Seventy-one participants from the NSF Institute attended the first academic-year seminar in November, 1986. Eighty-five attended the second seminar in December, 1986, including those who had also attended the collaborative's Summer Institute.

The Minnesota Mathematics Mobilization (M^3) is a project new to Minnesota, and it is intended, in part, to become a state version of the Mathematical Sciences Education Board. The project, funded by a three-year grant from the NSF to the University of Minnesota School of Mathematics and to St. Olaf College, is intended to provide a means of communication at the state level among educational, industrial and governmental leaders concerning precollege mathematics education. M^3 is intended to nurture projects of common interest to mathematicians, scientists, and mathematics educators; to articulate positions on important issues in a timely manner; and to represent the broad interests of mathematics education at all levels of education, industry, and government. Harvey Keynes and Lynn Arthur Steen of St. Olaf College are co-directors of M^3. Several times a year, M^3 publishes and distributes a newsletter to all mathematics teachers in the state, as well as to other mathematical scientists on its mailing list. The project sponsored a conference on May 10, 1986, on the Minnesota Postsecondary Options Enrollment Act (PSOEA); the registration fee for collaborative teachers was waived. A second M^3 conference on November 3, 1986, focused on the changing roles of teachers as encouraged by the Carnegie and Holmes reports. In the future, regional centers will be established around the state to encourage local communication among teachers and mathematical scientists.

On May 1 and 2, 1987, the Mobilization sponsored Mathematical Sciences Education Board hearings on its K-12 framework for the year 2000. Ten teachers and thirteen board members from the collaborative attended. Two teachers played leadership roles, participating on both May 1 and 2, while two others observed the general hearings on May 1. The collaborative paid all fees. The districts were asked to provide release time and to pay for substitutes. The mathematics consultants from each district were consulted to help with the selection process. Active members of the collaborative were given top priority.

The Minnesota Council of Teachers of Mathematics is very active. It sponsors fall and spring conferences and publishes its own newsletter. Future linkage with the Council will be pursued. A mathematics club for teachers from the Twin Cities area also provides social opportunities for mathematics teachers.

In St. Paul, a group of junior high teachers requested and received a school district mini-grant for 1986-87 to form mathematics-league teams in the junior highs. The $1,600 grant was shared among nine schools and paid for transportation, prizes and teacher time for writing problems. The teachers who applied for this mini-grant got the idea for junior high teams during the 1986 Summer Institute but submitted the proposal independently. Previously, mathematics leagues existed only at the high school level. The grant's advisor is a very active high school league teacher who serves on both the Steering and Teacher Advisory committees. Team coaches volunteer their time.

E. Project Activities

During the 1986-87 school year, the Twin Cities Urban Mathematics Collaborative sponsored a wide variety of activities for mathematics teachers designed to enhance professionalism and to create networks among teachers and representatives of business and higher education. These activities are described in the section "Collaborative Sponsored Activities." In addition, the collaborative promoted and provided support to teachers to participate in activities offered by other local organizations. These are described in the section "Collaborative Supported Activities."

COLLABORATIVE SPONSORED ACTIVITIES

TCMS Dinner Meetings

When the collaborative was established in 1985, the Twin Cities Mathematics Society (TCMS), formerly called the Twin Cities Pre-College Mathematics Society, was formed to organize functions that would facilitate professional and social contact among mathematics teachers, and university and industrial mathematicians. The society sponsored dinner meetings in March and in May, 1985. The success of these meetings prompted TCMS to schedule four more during the 1985-86 school year.

The success of the 1985-86 dinner meeting series prompted the Twin Cities Mathematics Society to sponsor another series of dinner meetings during the 1986-87 academic year. While the format of the meetings remained the same, a $2 reservation fee was instituted to discourage last-minute cancellations. As in the past, the dinner was free. Topics for the 1986-87 dinner meetings focused to a greater degree on teaching in a conscious attempt to determine whether this emphasis was more appealing to teachers.

The first dinner meeting for the 1986-87 school year was held October 22, 1986, at Macalester College. Two teachers, Marlys Henke and Terri Lentsch, discussed teaching techniques related to geometry and problem solving; the two took turns role playing the parts of the student and the teacher. This was the first teacher-directed meeting, and also the first at which the $2 registration fee was charged. The director felt that the forty-five people who attended represented a respectable turnout and indicated that the fee did not greatly deter attendance.

Results of an evaluation form returned by thirty-three participants indicated that, on a scale of 1 (poor) to 5 (excellent), the presentation was rated 4 by fourteen respondents and 5 by nineteen respondents. The ratings for the entire evening were either 4 or 5. Eleven of the respondents were newcomers, while twenty-one of the participants who responded to the questionnaire had attended previous dinners. Comments included: "Let's continue to bring in high school teachers as speakers"; "I wouldn't miss these for anything"; "Very good presentation and excellent presenters"; "I am crunched for time. Could I just come for the speaker?"

The second dinner meeting was held December 2, 1986. Tom Ressler of the University of Minnesota discussed teaching mathematics to minority students. While the collaborative's director expressed some concern that the topic may not be relevant to all teachers, he felt that it provided a unique dimension and should be tried. About forty people attended. The slightly lower number at this dinner prompted the director to consider reevaluating the $2 fee.

The third Twin Cities Mathematics Society Dinner Meeting was held February 12, 1987, at the College of St. Catherine in St. Paul. Approximately sixty people attended to hear Dr. Donald Boyd of Honeywell Corporation speak on "Programming Is a Mathematical Discipline." Dr. Boyd contended that error-free software will be developed only when programmers start using the solid problem-solving techniques of an engineering discipline. Programming should be based on and taught as mathematical principles of problem solving, he said. Dr. Boyd briefly reviewed the mathematical foundations of a computer program and showed how these foundations may be used as a disciplined approach to programming.

Attendance at the dinner was better than anticipated. The teachers present enjoyed the chance to socialize and rated the evening as "very good" or "excellent." The dinner drew several participants from the industrial and business communities. One teacher from a local community college commented, "I'm so glad to be invited. Enjoyed meeting the teachers and learned something from the talk." Another teacher said, "Very enjoyable--I brought my brother-in-law as a guest. He is also a math teacher and really enjoyed meeting so many people."

The fourth TCMS Dinner Meeting was held April 27, 1987, at the Macalester College Union. Approximately forty society members, including teachers, industry representatives, and instructors at small colleges heard Professor Walter Mientke of the University of Nebraska speak on the development of mathematical abilities. Professor Mientke is the Executive Director of all contests sponsored by the Mathematical Association of America (such as the National Math Olympiad, the National Math Exam, AHSE, and AIME). Teachers present considered the evening a success despite such technical problems as poor acoustics.

Overall, the 1986-87 dinner meetings series was viewed as a success. As the year progressed, the dinners drew an increasingly high number of participants from the small colleges (due to the efforts of Wayne Roberts and Ken Vos). Teachers' reactions also continued to be extremely favorable. After a dinner meeting one teacher said, "Everything was wonderful--just being with fellow mathematicians in a pleasant environment is worth so much. I feel different--it has a psychological effect. Teachers get so few perks, a free dinner with a good speaker just makes you feel good." Other teachers commented: "I can talk to people I never see. I can't tell you how great these have been. I have told every teacher I know who hasn't come"; "Camaraderie is super. I wouldn't mind if there were six meetings instead of four." Another teacher, who said that the activity was "definitely" worthwhile, asked, "Can we find some high school teachers who could give some talks? At least one or two of the speakers should be from our ranks."

Reaction from a representative of a high tech firm was equally positive. "I have met so many teachers and have been able to share my perspectives. . . . I really like being with the teachers." University representatives enjoyed the talks for the most part, but appeared to place less value on the personal contacts that they made.

1986 Summer Institute

A highlight of 1986 collaborative activities was a Summer Institute offered from 9 a.m. to 1 p.m. daily between June 20 and July 14. The program, which was restricted to collaborative members, focused on problem solving and enrichment topics for the junior high curriculum. It was taught by Professor Wayne Roberts of Macalester College. The seventeen participant teachers each received a stipend of $600 and $15 per week for transportation, as well as four mathematics credits from the Extension Division of the University of Minnesota. An announcement of the Summer Institute was sent to all collaborative members who responded to a survey distributed through a February 10 mailing and the March newsletter. Twenty-six applications with supporting transcripts and letters of recommendation were received by the April 7 application deadline. Twenty teachers and four alternates were selected. Of these, seventeen actually attended. Seven taught in six Minneapolis schools and seven taught in five St. Paul schools. The group also included two parochial school teachers and one private school teacher.

The daily schedule began at 9 a.m. with a problem-solving session at which sample problems and appropriate strategies were discussed. A 30-minute break followed, and then, frequently, a one-hour lecture by a representative of industry on a topic such as actuarial problems. From noon-1 p.m., teachers worked in groups solving problems. On occasion, an afternoon session was scheduled for a presentation from such visiting speakers as Tom Romberg, professor of mathematics education at the University of Wisconsin and Director of the UMC Documentation Project, who spoke on mathematical modeling and geometric probability.

Tom Romberg observed that in the morning session he attended all of the teachers were attentive and willing to guess, to propose solutions, and to generalize beyond the facts. The instructor of the workshop, Wayne Roberts, noted that the teachers were overcoming their initial expectations for immediate help or feedback.

The seventeen collaborative members who participated were junior high school teachers. Each was expected to devote a considerable amount of time to solving problems, as well as to developing a problem file to be used with his or her own classes. In addition, fifteen of the teachers developed curriculum modules to be shared with the other participants and to be used as resources for junior high teachers. The authors were to test their modules on students in the fall of 1986. In November, 1986, a one-page summary was prepared by the author(s) and submitted to Harvey Keynes. The summary included the title, the authors' names, a brief description of content, the school level targeted, the audience, and the state of completion of the project. The summaries were sent to all teachers who participated in the collaborative or NSF Summer Institute. Teachers who want a module copy can request one from the authors. The titles of modules prepared by collaborative Institute participants are: Critical Thinking in Mathematics; Discrete Additions to a Pre-Algebra Course; File of Problems for Slow Learners; Integrating Problem Solving into the Classroom; Problem Files (including problems for teaching a unit on problem solving); Problem Solving Using Pascal's Triangle; and Questions About "PI." The Modules are widely used by Minnesota teachers.

It should be noted that the National Science Foundation Teacher Renewal Project ran concurrently on campus with the collaborative Summer Institute. The NSF and UMC participants shared common break times and attended the industrial lectures together. Furthermore, because the collaborative supported five slots in the NSF Project, five additional collaborative members participated in this program. Overall, 105 teachers participated in the NSF Institute, each attending one of five classes oriented towards using problem solving in different content areas.

Reactions to the Summer Institute were extremely positive regarding instructional quality and the Institute's structure and context. Participants also rated favorably their interactions with colleagues. All but one participant reported that their knowledge of mathematics and problem solving had increased because of the Institute, and two people said they intended to enroll in further mathematics courses. One teacher commented, "I feel like a mathematician." Another observed, "For me, it is a rebirth in mathematics, a wanting to study and learn about mathematics and to bring some of this back to the classroom."

While all but one teacher felt that participation in the Institute would affect their teaching attitudes, methods and the style of their classes, the responses were less positive in terms of whether the participants felt they could be advocates for change. Six people did not foresee any change for at least the next year. Others viewed themselves as advocating a problem-solving approach among their colleagues and indicated that they felt comfortable doing so because of their "increased understanding of problem solving."

Participants also were very supportive of the collaborative's effort in aiming a program specifically at the junior high school teacher. Evaluation forms indicated that, prior to the Institute, many had felt that they were excluded and that their pertinent problems had been neglected.

One teacher noted, "Remember the junior high teachers when workshops are being planned. Too often the material is geared to senior high teachers who already have more than the junior high teachers to work with." Another wrote: "It must be stressed to companies, foundations, etc. the need for work at the junior high level. It seems to me more important or at least as important as focusing at the senior high level. This program (UMC) was so valuable."

Participants reported that one of the most important aspects of the Summer Institute was the interaction among teachers. "We need more of this in teaching," commented one participant. Another wrote, "Being with my colleagues was of tremendous benefit." The Institute's impact on the junior high teachers in attendance resulted in a number of them becoming more active in the collaborative. This interest was demonstrated by two teachers who agreed to serve on the Teacher Advisory Committee.

Academic Year Seminars

As in 1985, a series of Academic Year Seminars was planned as a follow-up to the Summer Institute. Meetings were scheduled Monday, November 3; Saturday, December 13; Wednesday, February 25; and Saturday, April 25. At each seminar, individual classes met for two hours, followed by a short meeting of all participants. The 1986-87 Academic Year Seminars are being held in conjunction with the NSF Teacher Renewal Project. The Saturday meetings were scheduled to enable NSF participants from out-of-state to attend some of the sessions. The collaborative participants will join the NSF participants in the general sessions.

All seminars except the first, at which participants worked on units and modules to be developed during the academic year, included a class with Wayne Roberts as an extension of what was taught during the summer. On December 13, 1986, Bert Fristedt spoke on "Aesthetics and Imagination in the Final Stages of Solving a Problem," emphasizing appropriate thinking during the final stages of problem solving or during the stage after the problem has been solved.

On February 25, 1987, nine of the seventeen teachers who participated in the 1986 Summer Institute attended a class with Dr. Wayne Roberts that focused on modules from the Summer Institute, and on the wonderful world of T.C. Mits based on the book, "The Education of T.C. Mits." The teachers also heard Philip Wagreich, Professor of Mathematics at the University of Illinois-Chicago Circle campus, discuss, "A Computer-Based Integrated Mathematics/Physical Science Program to Improve Problem Solving and Quantitative Skills in Elementary School and Junior High School (Grades 1-8)." Professor Wagreich is one of two principal investigators in a three year NSF-funded project that integrates mathematics, laboratory science and computers into elementary school classrooms. The cornerstone of the project is a Quantitative Physical Science curriculum that teaches the essentials of the scientific method: understanding the notion of a variable and determining the relation between variables through experimentation. The curriculum has recently been modified to include more mathematics and the use of computers as analytical tools.

While attendance was lower than anticipated, the teachers present enjoyed the speech. One teacher noted, "The speaker should have had more time. He had a lot to tell." Another said, "I'm getting enthusiastic about next summer."

On April 25, 1987, the fourth and final Academic Year Seminar was held at the University of Minnesota in conjunction with the NSF Academic Year Seminar. Ten of the seventeen participants in the 1986 Summer Institute heard Tom Romberg speak on the work of the NCTM Standards Commission and attended a class by Wayne Roberts on Finite Geometry. The class began with some discussion of Tom Romberg's talk and of curriculum change in junior high school. In addition, the participants dined with approximately eighty participants of the NSF Teacher Renewal Project. Wayne Roberts commented that "good ideas get money" and asked the teachers to write up their ideas for change.

One teacher commented, "I need this--it's the only time I talk to colleagues." Another said, "I wish we would have had more time for real discussion after Prof. Romberg's talk. I think it would have been very good--very informative--very stimulating."

Urban Mathematics Collaborative Newsletter

An important networking component of the Twin Cities Mathematics Collaborative is the "Urban Mathematics Collaborative Newsletter," which was first published in December, 1985. The newsletter is designed to encourage teachers to learn about and discuss issues related to their professional lives. It is sent to approximately 400 people, including all UMC teachers, and several industrial, business, university, college and school administrative personnel. Approximately 260 secondary mathematics teachers, including fifty private and parochial teachers, are on the mailing list.

The newsletter was published four times during the 1986-87 school year and once during the summer of 1987. It ranges from two to eight pages and includes information on projects available for teachers' participation and collaborative activities, as well as articles on such specific mathematics topics as "Nim Away Your Time" and summaries of relevant educational research. A "Teacher Feature" highlights the accomplishments of selected teachers. The newsletters are mailed to the teachers' homes. Forty teachers responded to a questionnaire regarding the newsletter; their overall impression was positive and they indicated that the length was about right, and that the layout was good. The teachers also provided suggestions for article topics, such as teaching methods, math games and puzzles, book reviews, and summaries of collaborative presentations. Some teachers included comments: "I thought it was great! Keep it up." "Please keep this easy to read." "Glad to read the biographies. Like 'teacher tips' idea, but not the one published as an idea." "The Newsletter keeps getting better and better." A university professor noted: "Please give me some extra copies--I have students intending to be secondary teachers. They need to see those problem-solving strategies."

COLLABORATIVE SUPPORTED ACTIVITIES

Conference on Computers in Secondary School Mathematics at Phillips Exeter Academy

Four teachers from the collaborative received funding to attend the conference on computers in secondary school mathematics in Exeter, New Hampshire, in June, 1986. Expenses for Judith MacAlpine and Charles Marston were funded through the Technical Assistance Project at the Education Development Corporation; two other area teachers, Ann Marie Shimkus and Marie Whelehan, both of St. Paul Academy, received funding through the Eli Lilly Foundation. The conference focused on the impact and application of the computer on the curriculum. Among topics discussed were discrete mathematics, new developments in mathematics, and issues in mathematics education.

The collaborative, in cooperation with the UMC Technical Assistance Project, funded a teacher to attend the 1987 computer conference at Phillips Exeter Academy.

NCTM Annual Meeting

The Minneapolis School District hired substitutes for any teacher attending the annual meeting of the National Council of Teachers of Mathematics in Anaheim, California, in April, 1987. At least four teachers from the Twin Cities attended.

Mathematical Sciences Education Board Hearings

The Curriculum Task Force of the Mathematical Sciences Education Board, in conjunction with the Minnesota Mathematics Mobilization, sponsored a two-day meeting and public hearing on curriculum reform in mathematics education on May 1 and 2, 1987, at the Raddison University Hotel in Minneapolis. The task force sought input and discussion on a draft of proposed curriculum changes aimed at the year 2000. The collaborative provided support to allow four teachers to attend. Numerous other teachers and nonteaching collaborative members also attended the hearings, and three were panelists or moderators.

The meeting was received enthusiastically. One teacher stated, "This is fantastic! I was so excited when I heard about the new curriculum proposals. My head is spinning--why aren't my kids here?" Another said, "What a trip! Just look at this group. Everyone is so excited--why are we waiting for 2000? Why aren't we out there right now? We need to talk to a lot of people. There'll be a lot of resistance--people don't like change." A third said, "I'm excited about being a math teacher right now."

Heinz-Otto Peitgen is the author of The Beauty of Fractals, which are defined as graphs of the Madelbratt sets. Peitgen spoke about the sets and their graphs, which had been vividly colored. He also showed Cray computer-generated movies of these functions as x goes to infinity. Peitgen is at the University of Bremen and University of California-Santa Cruz.

F. Observations

The Twin Cities Urban Mathematics Collaborative progressed in several areas during the 1986-87 school year. Discussion of the collaborative's growth will focus on four major issues: Project Management, Collaboration, Teacher Professionalism, and Mathematics Focus.

PROJECT MANAGEMENT

The collaborative's director, Harvey Keynes, continues to stress that the Ford Foundation has not provided enough money to allow him to hire an external project coordinator. Professor Keynes has said that the collaborative can afford to pay only $11,000 to $13,000 towards a salary--an amount which is insufficient to hire a full-time coordinator with a strong mathematics background and solid administrative skills. Professor Keynes also admits that the university model is not conducive to hiring an internal coordinator. Not only is it difficult to get a position approved, but fringe benefits raise the total cost significantly. Professor Keynes would much prefer to hire an experienced, qualified person on a part-time basis than a young, inexperienced person full-time.

During the 1986-87 school year, in lieu of a project coordinator, Professor Keynes hired well-qualified people to perform specific tasks at a set fee. Thus, Ms. Sally Sloan was hired as the teacher coordinator for an honorarium of $1,000 to work with the Teacher Advisory Committee, to help with the newsletter, and to provide an informal connection between the collaborative and the Minneapolis School District. While Ms. Sloan does not act as a formal district-collaborative link, her position in the district allows her to make these contacts.

The collaborative has begun the process of appointing teacher representatives at each high school and middle school in the Twin Cities. These representatives, who will each be given a stipend of $100, will be responsible for disseminating information about the collaborative to all mathematics teachers at each school. The cost of the proposed teacher representative program would total approximately $4,300. The on-site observer, Ms. Gerry Sell, also helps to disseminate information through the newsletter in her role as the collaborative historian.

Another major concern of the collaborative director has been the smooth decentralization of power from the director to the Steering and Teacher Advisory committees. Steps toward this goal have been taken this year in that the Teacher Advisory Committee has assumed more responsibility for generating ideas, which then are approved by the Steering Committee. For example, the idea of appointing teacher building representatives for each high school and each junior high school came from the Teacher Advisory Committee. After a vote by the committee, it was sent to the Steering Committee for final approval. Building representatives were identified by TAC members. Professor Keynes feels that TAC's increased responsibility has been a positive development.

Most teachers on the Teacher Advisory Committee have appreciated the experience of working with other teachers and the opportunity to affect collaborative decisions, although initially there was the feeling that the committee was primarily involved in reaction, rather than action. Teachers suggested several changes in the committee, including: increasing the number of teacher participants rotating membership so that more teachers would become involved; notifying members of the agenda well in advance of each meeting; and meeting more frequently at a convenient and regular time (such as prior to the Mathematics Society dinners). During the 1986-87 school year, the collaborative began to implement many of these suggestions, which has increased the effectiveness and impact of the TAC.

Another administrative concern involves the amount of time devoted to fund raising; the director feels that between February and June, most of his collaborative time was spent raising funds. While funding sources met their commitments during 1986-87, there is concern about the collaborative's ability to raise the $26,333 for 1987-88. For example, the school districts fulfilled their pledges for 1986-87, but it is unlikely that they will be able, or even willing, to provide funds next year. Strategies for raising the necessary funds have included asking for a commitment from private and parochial schools whose teachers benefit from the collaborative, asking for an increased commitment from local industries, and identifying new corporations that might contribute.

COLLABORATION

Collaboration in the Twin Cities takes a variety of forms, depending upon the activity. The Mathematics Society dinners and presentations provide the opportunity for teachers, business people, and university and college professors to interact with one another. All are members of the society and all are on equal ground in terms of status. Speakers have been selected from each of the three groups. The meals provide the time and opportunity for members to converse and to enjoy their shared interest in mathematics.

The Summer Institutes provide a different form of collaboration. Here the purpose involves providing teachers with information about mathematics. Representatives of business and higher education impart that knowledge to the teachers in a process which creates, in general, a one-way flow of information. A higher level of interaction is achieved between the teachers and the university faculty as problems and situations are discussed than would typify the lecture format frequently used in teaching mathematics. The Institutes do provide an excellent opportunity for teachers to interact with one another as they complete assignments and solve problems; by the end of the three-week sessions, participants have come to know one another well. Informal gatherings such as weekly picnics also allow casual interaction between the representatives of higher education and the teachers, fostering positive relationships outside of the classroom.

The effectiveness of these communication systems was demonstrated by teachers' response to a collaborative request that they administer the ATOMS test. The test was administered to nearly 3,000 students in the Twin Cities area.

Critical to the collaborative's future success is the significant involvement of the school districts. Additional efforts must be made to involve key personnel from the school district at all levels of collaborative support and decision-making. This has the potential of assuring that the collaborative becomes more deeply rooted in the districts and receives support after the Ford money is no longer available.

The span of activities in the Twin Cities testifies to the fact that collaboration is taking place. The form of this collaboration varies. What is becoming apparent is that people from all three sectors are getting to know one another better and are becoming more comfortable with one another--all in the context of a program defined by its strong mathematical focus.

TEACHER PROFESSIONALISM

There is a distinct difference in levels of collaborative involvement between teachers from St. Paul and those from Minneapolis. This situation may reflect differences in the relationships between the mathematics supervisors and the teachers in the two school districts. The relatively higher level of participation by St. Paul teachers may reflect a situation in which fewer district activities are being provided to them.

In the two school districts, contract negotiations focus on teachers' duties and hours of work. The transition from paid effort to a voluntary contribution of time and energy has yet to be made by the majority of teachers. Among the teaching population, older groups of teachers have been reserved about change and their involvement in it. Characteristically, members of this group who have attended collaborative dinners have done so without becoming involved in other activities.

The collaborative has achieved only limited success in finding teachers to attend summer activities away from the Twin Cities. Only one application was received to attend the Exeter workshop. The teacher who went last year, Ms. Judy McAlpine, applied to go again. Two teachers were identified to go to North Carolina for a fourth-year college preparatory mathematics curriculum workshop, but a third position went unfilled because teachers had too many other commitments.

The Minneapolis School District sponsored several teachers to attend the NCTM meeting in Anaheim, California, in spring, 1987. Unfortunately, they had little contact with the other UMC teachers at the conference.

The popular Summer Institutes provide opportunities for teachers to apply for advanced professional development. Teachers submitted written applications to attend. Those selected demonstrated both an initiative for self-improvement and a commitment to teaching.

The Summer Institute provides an environment in which teachers get to know other teachers and engage in doing mathematics. The Institute seems to provide a valuable opportunity for a professional experience, and interaction among the teachers in attendance continues during the school year. For example, in 1986-87 some of the junior high teachers, one of whom had participated in the Summer Institute, organized a math contest for St. Paul junior highs. Teachers' desire to repeat the Institute this year indicates that they have found it to be of value.

UMC teachers also have an opportunity to interact with the 105 teachers in the NSF Institute. Nine of these teachers come from the Twin Cities area, raising to thirty-one the number of Twin City teachers who are involved in a Summer Institute.

Teachers will be asked to assume more of the cost of the Professional Mathematics Society dinners in an effort to make the society a permanent, financially self-sufficient organization. During 1987-88, collaborative teachers will pay half of the cost of the dinner while teachers from surrounding districts invited to attend will be asked to pay the full cost of the dinners.

Another positive contribution of the collaborative has been its success in eradicating stereotypes. Teachers have discovered that college professors can possess teaching and pedagogical skills, as well as research interests.

A new area of interest for the collaborative may involve the development of programs and activities that respond to issues identified in such documents as the Holmes Report and the Carnegie Forum report. If the thrust of these documents is adopted, lead teachers will be looked to for curriculum development. The implications of this for the redefinition of teachers' work could be reflected in collaborative activities designed to prepare and assist these teachers.

MATHEMATICS FOCUS

The Twin Cities Urban Mathematics Collaborative is oriented towards mathematics and the expansion of teachers' knowledge about mathematics and mathematics education. The central theme of the collaborative has been, and will continue to be, mathematical problem solving in a variety of contexts. This, as well as mathematics applications and important issues and changes occurring in secondary mathematics, will be emphasized in the coming year.

The collaborative leadership views its strength, as reported in its proposal for refunding, as being "in a very strong and perhaps even unique position to provide intellectual leadership and excellent instruction in the area of mathematical problem solving and applications."

This leadership has been directed towards helping teachers to become better problem solvers and to produce classroom materials to help their students improve in the area of problem solving.

The Summer Institutes, which have been promoted by the collaborative for the last two years, are college mathematics courses planned for an audience that consists largely of junior high teachers. The Institutes are designed to help teachers to become better mathematicians and to learn more about mathematics and its applications, with the assumption that this will make them better teachers of mathematics. For example, the 1985 and 1986 Institutes, which focused on problem solving, have attempted to improve the problem-solving skills of teachers themselves, rather than to present problems for teachers to use in their classrooms. The teachers solved problems every day; about half of the time was then devoted to reviewing teachers' solutions and strategies. As Institutes progressed, the teachers began to produce materials for use in the classroom and to share these materials with one another. A third Summer Institute will be held in 1987.

G. Next Steps

A primary concern of the collaborative's leadership has been the identification of funding sources as the Ford Foundation withdraws its financial support. By August, 1987, the collaborative must find considerably more local money than was committed for 1986-87: $26,000 to $27,000, compared to $15,000. While some additional funds may be identified, it will be a challenge to identify other funding sources in a manner that will not dilute the energy that has been devoted to the substantive content and implementation of the collaborative's endeavors. Professor Keynes feels that, under the existing structure and governance, the intellectual quality of the project is materially undermined by the concern with fund raising.

During 1987-88 the collaborative plans to hire Steve Watson who will be on a Bush fellowship at the university. Steve will help coordinate the collaborative along with other special projects administered by the Mathematics Department.

Increased Responsibility of Teachers. A major goal over the next several years will be to encourage increased participation of teachers in collaborative decisions. A concerted effort will be made to assign greater responsibility to the Teacher Advisory Committee. As teachers become increasingly knowledgeable about and active in the collaborative, it is hoped that they will take more initiative in collaborative planning. The appointment of a teacher coordinator in January, 1987, helped to facilitate several teacher-directed projects.

Small Grants Program. The collaborative is considering a program of small grants to enhance teacher development. Grant proposals under review include: a teacher edited and published a journal of high school student mathematical problems; teachers produced instruments to increase motivation of junior high school students; teachers edited and published a set of actuarial--or other industry--oriented problems for high school students classified into subject areas.

Expanded Programs for the Twin Cities Mathematics Society. The Twin Cities Mathematics Society programs have been very well received. In order to increase their effectiveness and general appeal while involving teachers in these activities, several types of new programs will be considered. They include: TCMS industrial/teacher talks in which a representative from industry presents a topic and a teacher discusses its classroom implications; school mathematics articulation programs in which teachers present various program options available in the schools (i.e., talented and gifted, math-science magnets, minority involvement, benchmark testing); meeting sites that are directly related to programs, such as tours of industrial sites, colleges, museums, a zoological garden, or an arboretum.

Restructuring Twin Cities Mathematical Society. A new structure for the Twin Cities Mathematics Society is being considered that would open membership to non-collaborative members, and would include programs given by science-related speakers. A fee of $5 for collaborative members and $10 for noncollaborative members would be charged for the programs.

Activities during 1987-88 will resemble those of this year and will include: the Mathematics Society speaker/dinner programs; Summer Institutes and conferences; Academic Year Seminars on mathematical topics; support of collaborative members to participate in NSF Institutes and other professional conferences; mini-grants; university and public-school co-teaching of calculus; and tours of industries and businesses.

Conference Support. The collaborative plans to support as many as four teachers (two from each district) to participate in the fourth-year college preparatory mathematics curriculum designed by the North Carolina School of Science and Mathematics.

The collaborative, in cooperation with the Technical Assistance Project at EDC, will fund one person to attend the Exeter Computer Conference in summer 1987.

1987 Summer Institute. The theme of the 1987 Summer Institute will be a problem-solving approach to topics in number theory. While the course will be oriented toward the junior high or middle school teacher, the material to be discussed will be useful in the entire 7-12 curriculum. The Institute, which will be taught by Professor Wayne Roberts of Macalester College, will involve three components. First, the standard lecture format will be used sparingly to cover topics in prime numbers, modular arithmetic, integer representation, rational and irrational numbers, solutions to linear equations with integral solutions, and the theorems of Fermat and Wilson. The second component will draw upon number theory to solve problems, emphasizing fact teaching via problem solving. Finally, some class time will be used to discuss outside reading assignments which will help to place the subject of number theory in its larger mathematical context.

A principal goal of the Twin Cities Collaborative and hence of the Summer Institute is to help secondary teachers think of themselves as part of the larger mathematical community. The class will help teachers "indulge themselves as mathematicians, working on topics of genuine mathematical substance" that can be used to enrich virtually every subject taught in the secondary mathematics curriculum.

The class will meet four hours per day for three weeks, June 19 through July 10. The teachers will receive travel expenses, four 5-level mathematics credits, and a stipend of $600. Admission is available only to members of the Mathematics Collaborative, and priority will be given to teachers who participated in the previous collaborative or NSF Summer Institutes. The Institute will run separately from, but be complimentary to, the NSF Teacher Renewal Institute. The 1987 Summer Institute participants will be invited to attend talks presented to the NSF Institute participants the week before the Summer Institute starts.

SUMMARY REPORT: TECHNICAL ASSISTANCE PROJECT

by

Urban Mathematics Collaborative Documentation Project
University of Wisconsin-Madison

PURPOSE OF THIS REPORT

This report summarizes the work of the Technical Assistance Project during the 1986-87 school year. The report is intended to be both factual and interpretive. These interpretations have been made in light of the long-term goals of the Ford Foundation to increase the professional status of mathematics teachers in urban school districts.

The information presented in this report came from the following sources: the proposal submitted by EDC to the Ford Foundation for the continued funding of the Technical Assistance Project; information provided by the project staff; information disseminated through Common Ground, a computer network; the meeting in San Francisco in October, 1986, of representatives of all of the projects; the directors' meeting held in St. Louis in January, 1987; a meeting sponsored by TAP for school district mathematics supervisors from the collaborative sites in December, 1986; several joint meetings held during the NCTM Annual Meeting in April, 1987, in Anaheim, California; and meetings among the staff of the Documentation Project, the staff of the Technical Assistance Project, and Barbara Nelson of the Ford Foundation.

TECHNICAL ASSISTANCE PROJECT

A. Purpose

The Technical Assistance Project (TAP) was established to provide a broad range of assistance to the Urban Mathematics Collaborative project as a whole, as well as to the eleven individual collaboratives. Assistance is provided not only in response to direct requests from the collaboratives, but in response to needs identified by the Technical Assistance Project itself. It is the TAP's responsibility to keep informed of changes in the mathematics teaching profession and to communicate these insights to the collaboratives in meaningful ways. It is the project's goal to help provide a managed program of change, thereby facilitating each collaborative's growth and development in a way that fulfills the collaborative's own objectives. In particular, the Technical Assistance Project was established to:

1. provide the collaboratives with a resource network so that they may access expert information about ongoing mathematics activities, national professional organizations, new developments in curriculum, and current trends in issues of equity, industrial uses of mathematics, and teacher isolation;

2. provide opportunities for the members of the collaborative projects to participate in national and regional symposia, workshops, and pilot projects;

3. establish intercollaborative communication among the eleven collaboratives, using such means as an electronic bulletin board, a regularly published newsletter, and sponsorship of conferences to bring together people from each site who hold comparable positions (i.e., school district mathematics supervisors); and

4. provide assistance to the collaboratives in solving local problems and in identifying resources to meet local needs.

As the Urban Mathematics Collaborative (UMC) project evolves, the Technical Assistance Project will shift its focus to enabling each site to provide its own technical assistance. Furthermore, the Education Development Center (EDC), which is the funding agent for the TAP, will begin to share responsibility with TAP for providing outreach to publicize the work of the eleven collaboratives to a wider audience; to assist others in replicating or adopting the UMC model; and to influence educational policy regarding teacher education and professional development. During summer, 1987, EDC will finalize plans for an Outreach Project to serve the UMC project, scheduled to go into effect in September, 1987.

B. Context

The Education Development Center (EDC) has been integrally involved in curriculum development and teacher education since 1967. It has pioneered the use of new technologies as tools for teachers and learners; the establishment of the Technical Assistance Project within EDC is a recognition of the growing importance of the interaction between technology and education.

The EDC staff includes professionals with backgrounds in mathematics, mathematics education, cognitive psychology, artificial intelligence, and school and mathematics administration. Several staff members have technological backgrounds in electronic communications, computer hardware, and educational software development. A number of the EDC staff also are experienced in the area of teacher training.

Dr. Mark Driscoll, director of the Technical Assistance Project, allocated approximately 75 percent of his time during 1986-87 to the TAP. The TAP staff also included program assistant Melissa Fox, and technical assistant M. Grace Kelemanik, who worked half-time.

The Education Development Center has worked closely with Harvard University on many projects. For example, EDC currently has a contract with Harvard's Educational Technology Center to conduct research and to facilitate the use of computers in elementary and secondary schools. This project will focus on analyzing current trends in the use of technology in schools and disseminating the project's findings.

In addition to the Harvard contract, two other EDC projects are relevant to the objectives of the UMC project. One provides technical assistance to the Women's Educational Equity Act project, and the other, funded by NSF, is developing instructional materials in mathematics that integrate the use of technology.

When the Technical Assistance Project was established, a Mathematics Advisory Panel was formed, comprised of distinguished mathematics educators and representatives from major institutions, organizations, and agencies. The TAP has approached individuals on this panel as well as other distinguished educators to provide information and to respond to specific requests. These individuals, for example, have been asked to make presentations at collaborative symposiums, to write articles for the newsletters, and to respond directly to questions asked by collaborative teachers.

During the 1986-87 school year, the staff of the Technical Assistance Project also continued to meet, as needed, with other EDC staff to discuss issues related to the UMC project and to identify solutions. The TAP was, therefore, able to draw upon EDC's diverse resources as well as to involve other recognized specialists in providing technical assistance to the collaboratives.

C. Development of the Project

The Technical Assistance Project was established to provide proactive assistance, rather than simply to react to the discrete needs of individual sites. As a result, the TAP's role in the Urban Mathematics Collaborative project expands upon the traditional approach of providing technical assistance in that TAP not only reacts to requests from sites, but also initiates interaction with them. In this broader context, EDC draws upon its resources and expertise to provide challenges and leadership to the sites. Thus, the Technical Assistance Project is not a passive component that reacts only when called upon, but rather is an integral component of the Ford Foundation's overall efforts in the UMC project.

The role of the Technical Assistance Project has evolved as the UMC project has developed. The TAP and the collaboratives have become more interactive as project personnel have increased their understanding of the model of change on which the UMC project effort is based, as well as of the concept of collaboration that the Ford Foundation is attempting to foster.

Since its inception in 1985, the TAP has established a framework for providing technical assistance to the collaboratives. This framework evolved out of an awareness of the wide variety of types of information that may be useful to the UMC sites. The TAP staff has categorized the services and information it can provide into four major resource areas:

1. Substance: helping the UMC teachers to stay at the forefront of their profession in terms of their knowledge of changes in mathematics and cognitive research, and in their awareness of mathematics education resources.

2. Governance: helping the collaboratives to function smoothly now and in the immediate future, and to plan for their long-term futures.

3. Communication: helping the individual collaboratives to develop a sense of identity and distinctiveness, and to create their own internal resource networks.

4. Self-sufficiency: providing the collaboratives with the assistance they need to operate smoothly, with particular attention to their capacities to tap resources outside the UMC network.

D. Relationship with Other Initiatives

The Technical Assistance Project is only one of many EDC projects that impact on mathematics education. Several other EDC projects relate closely to the efforts of the UMC project. For example, the NSF has awarded EDC a grant to define a new approach to mathematics learning and teaching for grades K through 6. Mark Driscoll, the director of the TAP, assists in managing this grant; as a result, he meets periodically with directors of the seven other NSF grants. This provides Dr. Driscoll an opportunity to receive input from other projects actively engaged in reforming curriculum in grades K-12 and to relay this information to the Urban Mathematics Collaborative sites.

In the summer of 1986, the Ford Foundation provided a grant to EDC (in addition to its funding of the UMC project) to develop materials for inner-city teachers to use in motivating students at risk in mathematics. A. Alif Muhammad, a black mathematics teacher at the Cambridge Rindge and Latin School in Cambridge, Massachusetts, was hired as an EDC project associate. Mr. Muhammad took a leave of absence for the first semester of the 1986-87 school year, and worked for EDC through February, 1987, to develop a training program designed to enhance self-esteem in inner-city mathematics students. The program emphasizes methods of stimulating students to value acquisition of academic knowledge and skills, not merely as "tickets" to extrinsic rewards, but as a means of achieving self-actualization and improvement in personal competence and quality of life. The program includes demonstrations of exemplary supplementary curriculum materials, as well as observation and discussion of various approaches to pedagogy as presented in videotapes. Mr. Muhammad interviewed educators in several urban areas in researching approaches to pedagogy for inclusion in his training program. He has presented the program at a TAP-sponsored meeting of mathematics supervisors, as well as at other collaborative gatherings.

Dr. Driscoll has established a working relationship with the Society for Industry and Applied Mathematics, which has expressed interest in the UMC project. In addition, Dr. Driscoll also is in communication with the Mathematics Association of America's task force on minorities. Members of this committee have served as resources to individual collaboratives and will make presentations at future UMC meetings.

E. Project Activities

Visits to Collaborative Sites

Dr. Driscoll attempts to visit each of the collaborative sites at least once each year. During 1985-86, these visits enabled him to become acquainted with each site and to identify potential technical assistance needs. These visits also provided the collaboratives with an opportunity to learn more about the TAP and the resources it could provide.

During 1986-87, the site visits were directed toward developing a more explicit understanding of the processes of collaborative administration. After a March visit to the Philadelphia collaborative's Advisory Committee, Dr. Driscoll's subsequent site visits were scheduled to coincide with advisory board meetings as a means of determining how these committees function. When appropriate, Dr. Driscoll assisted the collaboratives by recommending local individuals as potential advisory committee members and by clarifying and helping to define reasonable goals for and expectations of the committees.

Information Services to Sites

The Technical Assistance Project provides information to the collaboratives on a variety of topics. Most often, information is distributed through site visits, mail, electronic mail, and a newsletter. In disseminating information to the sites, the TAP assumes the multiple role of a clearinghouse, a contractor, and a prime source of information.

As a clearinghouse, the Technical Assistance Project keeps collaborative sites informed about major initiatives in support of mathematics education, new curricular developments, and opportunities for teachers to participate in regional and national events. Since its inception, the TAP increasingly has turned to the individual collaboratives as sources of information that can be shared with other sites. For example, the TAP disseminated information about corporate grants that have provided support to collaboratives in various cities; in response to a request, the TAP provided information about Philadelphia's Math in Applications course to another site; and information on the teacher internship programs in place at several sites was sent to another collaborative considering such a program. The TAP has used its networks to seek out and distribute information that may be relevant to the collaboratives, including news on current curriculum developments, on mathematics education materials, and on new projects. TAP has distributed to the collaboratives materials on AAAS Project 2061, available mathematical software, the Applied Mathematics Program of the Center for Occupational Research and Development, and the Chemical Education for Public Understanding Project of the Lawrence Hall of Science.

As a contractor, the TAP arranges for experts on specific topics to make presentations at collaborative activities. In some cases, this involves providing a list of potential speakers to the collaborative, which then makes its own arrangements. The TAP, for example, recommended Ross Finney as a speaker on mathematical applications; Finney made presentations to both the San Francisco and the New Orleans collaboratives. Based on a TAP recommendation, Bill Kernahan of Sunburst Communications led a Geometric Supposer workshop for thirty-one teachers of the Philadelphia collaborative in May. In other cases, the TAP has provided partial funding for a workshop speaker. For example, TAP provided partial funding for Dr. Richard Houde to speak on the Geometric Supposer to collaborative teachers in Durham, Los Angeles, Memphis, and Pittsburgh.

The TAP also serves as a prime source of information. Following each site visit, Mark Driscoll corresponds with the collaborative, summarizing his thoughts and reflections on what he observed and the issues that were discussed. Frequently, this correspondence offers the names of experts who could be contacted about a topic discussed during the visit. The TAP draws not only on Dr. Driscoll's own experience and knowledge of mathematics education, but also on the expertise of others at EDC in such areas as management, organization, and educational technology.

Telephone Hotline

Since its installation in September, 1985, a toll-free telephone number has been used frequently by sites to contact the Technical Assistance Project. The hotline was used approximately eight to ten times a week during the school year. In general, callers request information on curriculum materials or articles on a particular topic.

Common Ground Computer Network

On October 1, 1986, the Technical Assistance Project initiated an electronic communication system to link all collaborative sites, as well as the Technical Assistance Project, the Documentation Project, and the Ford Foundation. The network, called Common Ground, is an electronic mail-and-message system developed especially for teachers by the Educational Technology Center at Harvard. By the end of the 1986-87 school year, all of the collaborative sites but New Orleans (which did not have the appropriate computer), the TAP, and the Documentation Project were on line. New Orleans is projected to be on line by spring, 1988. The TAP supplied each site with a modem and the necessary software to access the network.

Common Ground usage has evolved over the year. In its early stages, Common Ground was used primarily to send brief messages directed either at requesting specific information or describing an activity. In December, 1986, four Common Ground "forums" were initiated; as collaborative members participated in the forums, they began to use Common Ground to exchange information and insights on key issues. These early forums, all moderated by EDC staff, focused on four topics considered of particular interest to the collaborative sites: mini-grants, resources, update, and educational technology. The mini-grants forum offers the collaboratives a means of exchanging information about funding sources and mini-grant programs. The resources forum provides information on both material and human resources. The update forum allows individual collaboratives to inform other sites about the activities it has planned. The educational technology forum enables collaborative members to share ideas on the use of calculators and computers in the classroom. In March, the TAP added a fifth forum, notices, to provide a space for general announcements as a means of keeping all eleven collaboratives informed of new opportunities and events.

In March, 1987, a Common Ground forum on governance was initiated, with Sue Stetzer, coordinator of the Philadelphia Math Science Collaborative, as moderator. A key impetus for establishing the governance forum was Ms. Stetzer's own questions about the formation of a PMSC advisory committee, including its composition, its organization, and its role. Ms. Stetzer contacted TAP for input on these issues as they were being addressed in Philadelphia. The TAP staff suggested that she moderate a forum on governance. Ms. Stetzer began the forum by asking two questions: How do advisory councils function for each collaborative? How do we get business and academic folks more involved? By the end of June, 1987, twenty-four messages had been posted in the governance forum. Ms. Stetzer allows time for participants to respond to a question and to read other responses before posting another question..

Six nationally recognized educators, each with a specific area of expertise, were added to the Common Ground network at the close of the 1986-87 school year. These experts will participate in the forums by responding to questions and offering insights. Arthur Powell, a mathematics teacher in the Academic Foundations Department at Rutgers University, has developed alternative teaching strategies for unsuccessful mathematics students. Richard Houde, a mathematics teacher at Weston High School, Weston, MA, is a well-respected authority on the Geometric Supposer. Rudd Crawford, a mathematics teacher at Oberlin College and High School in Ohio, developed the Stella Index System for cataloguing problems. Uri Treisman, of the mathematics department at the University of California-Berkeley, directs a program for improving minority students' success in mathematics. Daniel and Molly Watt direct the Logo Learning Project at EDC. The Common Cround Network will be expanded further during 1987-88 to include teachers who are using the Geometric Supposer and consultants from a variety of sites.

By June, 1987, nearly sixty individuals, including those from ten of the eleven sites, were participating on Common Ground. Individual participation varied greatly, from daily use to use less than once a month. On the average, eight to ten different people log on to Common Ground during any given week. EDC has encouraged each collaborative to designate one of its members to log on to Common Ground at least twice each week.

Annual Meeting of Collaborative Project Staffs

The Technical Assistance Project is responsible for coordinating an annual conference for all Urban Mathematics Collaborative project staff. The first such meeting was held in Cleveland in 1985; the second meeting was held October 15-18, 1986, in San Francisco. Fifty-two people attended this meeting, including the director, coordinator and on-site observer from each site; four members of the Documentation Project; four representatives from EDC; four representatives from the Ford Foundation; and one person from the Carnegie Corporation. The activities of each site, including the Documentation Project and the Technical Assistance Project, were discussed at general sessions. Participants also attended small-group sessions to discuss issues relevant to their specific roles in the collaboratives. Extracurricular activities included a visit to the San Francisco Exploratorium, dinner at a Chinese restaurant, and dinner at the St. Francis Yacht Club.

The overall rating of the meeting, based on responses from twenty-four participants who returned evaluations, averaged between "very good" and "good." Nearly all of the respondents either agreed or strongly agreed that the objectives for the meeting were clearly stated and satisfactorily accomplished, that the material was useful and that it stimulated thought, that they were able to exchange experiences, and that the meeting helped them to think about alternative strategies and approaches. The most beneficial aspect of the meeting, as reported by the participants, was the opportunity to interact with one another and to become familiar with what was happening at the other sites. Interaction among people from the various collaboratives has changed the approaches of some sites. For example, after the meeting, one collaborative reconsidered the importance of teacher involvement and restructured its advisory committee to include more teachers. This collaborative also decided to increase personal contact with teachers by visiting each participating school several times.

Steering Committee for the UMC Annual Meeting in New Orleans in October, 1987

At the 1986 UMC meeting in San Francisco, a committee to plan the agenda for the UMC 1987 Annual Meeting was identified. Dr. Keith Brown, Director of the Durham Mathematics Collaborative, chaired the committee. Other members included Mark Driscoll; Project Coordinator Toby Bornstein, Los Angeles; and Project Directors Judy Morton, St. Louis; Paula C. Fay, Cleveland; and Constance Barkley, New Orleans. Initial planning took place over

Common Ground. On May 19, 1987, all committee members were present, with the exception of Dr. Brown, who had just broken his leg. The Technical Assistance Project sponsored committee members' attendance at this meeting.

Funding of Teacher Participation in Outside Projects

During 1986-87, the Technical Assistance Project funded teachers from several collaboratives to meet with one another and to attend national conferences. These teachers greatly appreciated the opportunity to meet with their peers from other cities and to participate as a group in important national, professional conferences. Through these experiences, teachers from the eleven collaboratives are gaining both a self-identity and an identity as UMC teachers. They are also beginning to share with others important information about their work and their UMC participation.

During summer, 1986, the Technical Assistance Project funded fifteen teachers, representing five of the seven collaboratives in operation at that time, to attend a summer workshop on computers in schools at the Phillips Exeter Academy in Exeter, New Hampshire. Individual collaboratives sponsored additional teachers to attend this conference. As a follow-up to this meeting, the Technical Assistance Project offered to fund Los Angeles teachers to visit San Diego to meet with teachers from the San Diego collaborative, but this did not take place.

On November 22, the Technical Assistance Project funded one teacher from Pittsburgh to attend a users' conference on the UCSMP curriculum. This teacher accompanied the Pittsburgh school district's mathematics consultant, Dr. Diane Briars.

The Technical Assistant Project helped fund two teachers from the Los Angeles collaborative to spend a week in November working in several Boston-area high schools. These schools are using the Geometric Supposer, which was developed at EDC in conjunction with Harvard's Educational Technology Center. In addition to becoming familiar with the software, the teachers visited an exemplary resource center to review other geometry software and to meet with staff. These teachers, as well as those who attended other EDC-sponsored activities, made several presentations to other UMC teachers at the 1987 NCTM meeting in Anaheim, in April, 1987.

Meeting of Mathematics Supervisors

In December, 1986, the Technical Assistant Project sponsored a meeting in Boston for the school district mathematics supervisors from each of the collaborative sites. Supervisors attended from all of the cities, with the exception of Cleveland, as did Tom Romberg, Director of the Documentation Project.

The meeting opened on the evening of December 14 with an informal Chinese dinner. No program was scheduled to allow participants an opportunity to unwind from their travels and to get to know one another. The formal meeting began at 9 a.m. December 15. Mark Driscoll explained the Technical Assistance Project, and Tom Romberg briefly described the Ford Foundation's UMC project and the Documentation Project's role in it. Each of the supervisors was then asked to comment on the problems, activities, and perspectives of his or her district. It was interesting to note that the problems identified by the supervisors related to students and not to teachers. They included low pupil achievement, low minority participation in advanced courses, and the pressures of increased graduation requirements.

During the afternoon, EDC staff made two presentations. The first was a new videotape on multiple representations of mathematical concepts and was very well received by the supervisors, who all requested--and received--a copy for their districts' use. In addition, Project Assistant Alif Muhammad discussed motivational activities designed to enhance students' self-esteem. This presentation also was well received, as it addressed a problem common to all sites. The supervisors requested a copy of the written report, which has been completed and will be distributed during the 1987-88 school year.

The remainder of the day was devoted to discussion of a series of questions prepared by Mark Driscoll that addressed the issues of teacher isolation, ways to motivate teachers to take advantage of professional opportunities, increased mathematics requirements for students, drop-outs, technology, underrepresentation of minority students in mathematics, teachers not fully qualified to teach mathematics, and evaluation. Participants suggested that the issue of how to change teachers' and parents' low expectations of students should also be included in the discussion. It was agreed that each question would be addressed at each site, and participants would share insights and ideas from their individual discussions at a later date. In fact, supervisors agreed that meeting together was important, and that future meetings were warranted.

UMC Activities at the NCTM Annual Meeting

On April 7, 1986, Mark Driscoll, PMSC Coordinator Sue Stetzer, and LAUMC Coordinator Toby Bornstein presented a session on the UMC at the annual meeting of the National Council of Supervisors of Mathematics, which preceded the NCTM meeting. Twenty-five people attended, including eight who were in some way associated with the UMC project. Dr. Driscoll presented an overview of the UMC project and identified its four areas of concerns: professional development, mathematics uses, collegiality, and use of resources. Ms. Stetzer and Ms. Bornstein offered anecdotal examples from their own collaborative experiences of each of the four areas. Questions from the audience focused on staff development and permanence of the collaboratives upon termination of Ford funding.

The TAP hosted an afternoon event on each of the three days of the NCTM Annual Meeting. On Wednesday, April 8, the TAP sponsored a reception for all those associated with the UMC project. Nearly seventy-five people attended, including several representatives from each of the eleven sites. Teachers were present from most of the sites. A few non-collaborative people, such as a representative from AAAS, also were present. Mark Driscoll made a few introductory remarks and a representative from each of three sites--Los Angeles, Twin Cities, and Philadelphia--briefly described a recent collaborative activity. The remainder of the two-hour session was unscheduled to allow participants an opportunity to become acquainted and to share their insights and experiences with representatives of other sites. The event was very well received and those in attendance seemed to enjoy meeting and talking with people from the other sites.

On April 9, from 4 to 6 p.m., a small-group interaction session, Strategies for Implementing New Ideas, was offered by the TAP. Seventy people associated with the UMC attended this meeting, including at least one representative from each site. The session focused on the role of teachers in school reform. Toby Bornstein, coordinator of the LAUMC, worked closely with Grace Kelemanik of the TAP staff in planning and preparing the session materials. Toward the end of April, EDC sent each collaborative a chart listing the obstacles and strategies that were identified by each group.

TAP's April 10 session, "Bringing It Home," was designed to provide collaborative personnel an opportunity to discuss the highlights of the NCTM conference and to determine how each collaborative might implement some of the ideas presented. About thirty-five people attended. They divided into small groups to discuss the meeting and the interesting presentations they had attended. Several groups were able to identify some specific action that could be taken to implement new approaches within their own districts. For example, one teacher from a California site had heard the Superintendent of Public Instruction, Bill Honig, say that he would insist on more teacher in-service days. This group brainstormed about what the collaborative could do if it were to be given responsibility for these in-services. Although the session ended formally at 5:30, a number of participants remained to continue conversations.

Grant Writing Consultation

During the 1986-87 school year, Dr. Driscoll assisted three collaboratives in brainstorming ideas and developing proposals for NSF grants targeted at the middle school level.

Newsletter

. The Technical Assistance Project publishes its own quarterly newsletter, which is designed to raise issues and direct awareness to concerns relevant to the development of the UMC initiative as a whole. The first issue of UMC Angles was published in March, 1986. Approximately 700 copies of each issue are distributed to collaborative sites, project directors, project service sites, and representatives of national organizations. During the 1986-87 school year, issues were published in September, February, and June; features included editorials by EDC staff; reports on collaborative activities; reviews of such resources as computer software, videotapes, and Common Ground; commentaries from experts on mathematics, mathematics education, and reform; and reprints from other publications, including collaborative newsletters, the New York Times, the Los Angeles Times, and Notices of the American Mathematical Society.

Beginning with the 1988 winter issue, the newsletter will be redesigned and its distribution expanded to include business, education, and policy communities. In addition to serving the needs of the eleven collaboratives, the newsletter will be used to inform a larger audience about the UMC project and its impact.

UMC Brochure

In late March, TAP produced a brochure describing the Urban Mathematics Collaboratives. The brochure included a brief description of the project's goals, an overview of collaborative activities, and expected project outcomes. The names and business addresses of each collaborative project director also were included. TAP was responsible for the brochure's design and for allowing several collaborative directors to review it. Copies of the brochure were distributed at the NCTM Annual Meeting and were provided to the sites to be used at their discretion.

F. Observations

The role of the Technical Assistance Project has evolved with the development of the UMC project. During the project's first year, personal interaction with the seven sites constituted the main mode of assistance. Much of the TAP's effort was directed toward acquainting the sites with the breadth of resources available from EDC and "reactive listening" to identify the collaboratives' concerns and needs for assistance. TAP spent much of its time synthesizing information for distribution to all seven collaborative projects and fostering communication among the sites.

With the expansion of the project to eleven sites in the fall of 1986, and with the continued maturation of the original seven sites, the demands for technical assistance and the approaches taken to provide that assistance have changed. The Common Ground electronic communication network, initiated at the start of the 1986-87 school year, has fostered increased communication among sites and made information dissemination more efficient. Networking among the sites and "outside" experts has increased significantly. Information on recent advances in the use of technology in the teaching of mathematics has been regularly distributed by the TAP, and is starting to impact on a number of the sites. The collaboratives have been able to address organizational problems and issues in project development, which have become more apparent as the sites matured, through consultation with the TAP and in networking with other collaborative sites. Upon request, the TAP also has provided sites with strategies for involving representatives from business, industry, and higher education. The Technical Assistance Project also has helped to enhance the professional growth of a number of teachers, as well as of others associated with the collaboratives, by promoting attendance at professional meetings. TAP has sponsored several meetings, has publicized others, and in some cases, has provided funds for collaborative members to attend events sponsored by other agencies.

It appears that the Technical Assistance Project has become an integral element of the UMC project. All eleven sites have become aware of the benefits available to them through the resources TAP can provide. While some sites have used the TAP's services more regularly than others, all the collaboratives have taken advantage of the services provided by TAP at some point during the 1986-87 school year.

Observations on the Technical Assistance Project for the 1986-87 school year will be organized under the same four headings used in commenting on the eleven sites. In this report, however, the topics are meant to provide a framework for reflection on the TAP's assistance to the collaboratives, rather than to address the structure of the TAP itself.

PROJECT MANAGEMENT

As the school year progressed, the Technical Assistance Project turned its attention to the issues of project management and organizational development. This refocusing evolved as the more mature collaboratives began to turn their focus from getting-started activities to building a lasting structure. TAP identified several key issues, including encouraging teachers to take a greater leadership role and more initiative in collaborative management, having advisory boards assume a meaningful role in collaborative development, and removing the isolation of and increasing the support for collaborative management.

Dr. Driscoll's site visits and his insights as a third-party observer comprised the foundation of the TAP's efforts to help the collaborative projects address management issues. These insights were often influenced by the input of other EDC staff. In the spring of 1987, Dr. Driscoll realized that his attendance at collaborative advisory board meetings could promote a deeper understanding of the role that such a group could assume and could facilitate the sharing of this information with other collaboratives' boards. On occasion, Dr. Driscoll assumed the role of intermediary between key people in collaborative management. At one site, he helped the coordinator and director to better understand their roles and how the collaborative could work within its existing organizational structure. At another collaborative, Dr. Driscoll helped to foster increased communication and interaction between the school district administration and the collaborative. At their winter meeting, collaborative directors asked the TAP to help them ensure the survival of the collaboratives; in response, the TAP made an effort to inform the collaboratives about outside resources that could be of assistance, including an organization known as a developer of innovation and team problem solving in business.

The availability of Common Ground made it possible for coordinators and directors of the collaborative projects to engage in meaningful dialogues on issues of governance. With the establishment of Common Ground, the TAP facilitated networking among collaborative managers so that they could benefit from one another's experiences. While discussions among collaborative leaders at the fall UMC Annual Meeting and at the winter directors' meeting also were instrumental in fostering networking among the collaboratives, Common Ground greatly magnified the effects.

In order for technical assistance to be relevant to and to impact on the area of project management, a balance must be struck between what will be needed in the coming year or two, and what the collaboratives currently are prepared to handle. This year, technical assistance in project management was directed more toward current needs and problems than it was to building structures for the future. As some of the projects begin to prepare their final proposals, and to address the issues of permanence and organizational structure, a need for more future-oriented technical assistance will emerge. The Technical Assistance Project must be prepared to meet this need.

COLLABORATION

The efforts of the Technical Assistance Project have been instrumental in helping the individual collaborative projects to identify themselves as part of a larger national effort. The sites are developing a sense of community that has, in turn, fostered an awareness of project membership that transcends the local site. TAP has placed a high priority on developing networks among the eleven collaboratives, as well as between collaborative members and outside consultants.

Common Ground, the electronic bulletin board, has been a key facilitator of this kind of communication. Common Ground has made it possible for people from the various collaboratives to keep in touch in a relatively straightforward, convenient way. TAP also has fostered and facilitated contacts among and within the collaboratives and has helped to link experts on various topics with collaboratives in need of such expertise. Richard Houde, a teacher in Weston, MA, offered training on the Geometric Supposer to teachers in Los Angeles, and Uri Treisman, University of California-Berkeley, an expert on teaching minority students, has interacted with teachers at four of the sites. Both Houde and Treisman now participate on Common Ground.

The TAP also has sponsored various meetings to encourage a sense of unity across the collaborative projects. The annual UMC meeting and the more focused meetings of the project directors and of the mathematics supervisors provided opportunities for networking, problem solving and interaction as participants worked to solve the problems common to them all as teachers and administrators in inner-city schools. The UMC receptions TAP sponsored at the NCTM Annual Meeting also helped to strengthen the professional bonds among collaborative members from all sites.

A few sites have requested assistance in involving local businesses in collaborative activities, either through direct participation or contributions. TAP often draws on other collaboratives for help in identifying this type of resource and has facilitated this process by sharing the names of corporate funders among sites. Dr. Driscoll helped one collaborative to develop a "marketing approach" to engage more business people. He suggested that the collaborative convey the message that the time has come for change, that the UMC is an economical and sensible vehicle for bringing teachers into the change process, that the collaboratives have identified explicit ways to encourage teachers to grow and change, and that buying into the UMC project means buying into a network of projects in which resources multiply.

Thus the TAP has been effective in generating collaboration among the sites and in assisting as needed to help sites with their own collaboration. The meetings of the directors and the mathematics supervisors have helped these groups to develop and network. Although a separate meeting of the coordinators has not yet been scheduled, the coordinator is often the person most actively involved in collaborative planning and could benefit from an opportunity to interact with his or her peers.

During the 1986-87 school year, only the collaborative directors and coordinators had access to Common Ground. As the school year came to a close, however, plans were underway to include several teachers in the network. Such expansion has the potential of generating a form of collaboration across the sites that was not envisioned when the project began; this is one example of the ways in which the TAP and Common Ground have impacted upon the direction of the UMC.

PROFESSIONALISM

The TAP has influenced the professional lives of teachers at the collaborative sites by providing opportunities for them to attend professional meetings. For example, the TAP funded teachers to attend the Phillips Exeter Summer Institute. The Technical Assistance Project also keeps sites informed of such meetings by distributing lists of regional conferences, UMC Angles, and through notices sent over Common Ground. UMC Angles often contains articles written by collaborative teachers, so that teachers are serving as valuable sources of information. Dr. Driscoll continues to look for additional opportunities for teachers to provide input into each collaborative, and will make note of this to the individual collaboratives when appropriate.

As part of its informational function, TAP also stays current on developments in the mathematics teaching profession and alerts the collaboratives to pertinent research and findings. It should be noted, however, that while TAP serves as a clearinghouse of information on teacher professionalism, the real enhancement of teachers' professional lives occurs at the individual sites.

MATHEMATICS FOCUS

The Technical Assistance Project has provided guidance and information to the collaboratives on a wide range of mathematics topics, instructional materials, and instructional procedures. This range is somewhat reflective of the variety of requests the TAP has received, but three major areas can be identified in which the TAP has taken the initiative in supplying information to the collaboratives: the use of technology in mathematics instruction, reform of the mathematics curriculum, and the application of mathematics in business and industry.

Each of the year's three issues of UMC Angles offered information on the use of technology in the teaching of mathematics, including articles on the Geometric Supposer, on the power of graphing software, and on a conference on computers in secondary mathematics. Furthermore, the TAP paid for teachers from each collaborative to attend the Phillips Exeter Academy summer workshop on computers in schools. The TAP also funded workshops on the Geometric Supposer at some sites and distributed supporting materials on software, including a list of available mathematics software that was sent to all sites.

The TAP's efforts have also focused on the reform of the mathematics curriculum. The June, 1987, Angles issue included articles by two nationally recognized mathematics educators offering their perspectives on the reform movement in mathematics education and the changes in secondary school mathematics expected in the next ten years. The TAP also has distributed to the sites article reprints on Project 2061 and the work of Mathematical Sciences Education Board (MSEB). Plans are underway for a session on reform in the mathematics curriculum to be held at the next UMC annual meeting; the MSEB Framework and the NCTM Curriculum and Evaluation Standards will be discussed. The TAP is very much aware that the collaboratives can be instrumental in the reform of mathematics education and it continually raises the issue of the role teachers should play in mathematics curriculum reform. The UMC reception/workshops at the NCTM Annual Meeting focused on changes in mathematics education, and activities required participants to identify strategies for removing obstacles that may prevent or slow change in the use of problem solving, manipulatives, discrete mathematics, and technology.

In response to collaborative interest and requests, the TAP has identified the application of mathematics in business and industry as one of its most important areas of concern. TAP efforts in this area have included distribution of reprints on the applications of mathematics, as well as announcements of such programs as the Industry Initiatives for Science and Math Education occurring in the San Francisco Bay Area.

Other mathematics topics identified as important include motivation of borderline mathematics junior high and high school students, and equity in the teaching of mathematics education. In response to site requests, TAP has provided information and direction in these and other areas; for example, TAP has recommended speakers to make presentations on various topics at individual sites. The TAP staff is considering ways to assist the sites to become more aware of recent psychological and cognitive science developments relevant to the teaching of mathematics.

The effects of TAP efforts have begun to emerge in the collaboratives. The increased use of the Geometric Supposer at collaborative sites must be attributed, at least in part, to TAP involvement. The collaborative projects' knowledge of the reform movement in mathematics education has been influenced by the materials TAP has provided, as well as by the continual efforts of the TAP to shed light on and promote the reform agenda. In this context, the collaboratives are an integral part of mathematics education reform in the schools. The forward-thinking experts recommended by TAP to speak at collaborative activities have helped to raise teachers' consciousness about current concepts of mathematics and about what should be included in the mathematics curriculum.

The TAP faces the dilemma of whether it should be leading collaboratives to accept nationally defined changes in the mathematics curriculum or providing assistance to collaboratives in whatever direction has been locally determined. Since its inception, TAP has assumed a more proactive approach in creating opportunities for collaboratives to take a direction in alignment with current thinking in mathematics education. It is hoped that this approach will be continued and that the knowledge, experience, and insights of the collaborative teachers will be viewed as a voice for curriculum relevance to inner-city students and as evidence that progressive changes are not only well within the reach of inner-city students, but are a necessity if these students are to be competitive in the age of information and technology.

G. Next Steps

The Technical Assistance Project will continue to provide assistance to the collaboratives in the four general areas of substance, governance, communication, and self-sufficiency.

The specific activities that the TAP has planned for the 1987-88 school year include conferences, networking, collaborative assistance, and publishing.

UMC Conferences

- planning and conducting the UMC Plenary meeting in October in New Orleans;
- facilitating the efforts of the planning committee for the 1988 UMC Meeting;
- sponsoring meetings associated with the NCTM Annual Meeting, including a gathering of project coordinators;
- sponsoring a one-day meeting on effective teaching models for collaboratives in which this is an issue;
- sponsoring a meeting of district mathematics consultants;
- considering whether to organize and sponsor a directors' meeting.

Supporting Other Conferences

- supporting or assisting participation in the Phillips Exeter Computer Conference;

- supporting the national conference in Durham on the changing role of teachers;
- supporting a study group of teachers using the Geometric Supposer in classrooms.

Networking

- networking with the MAA task force on minorities, and the Council of Great City Schools.

Collaborative Assistance

- assisting collaboratives with team building training and vision development;
- promoting communication among sites and developing additional forums on Common Ground;
- helping collaboratives to identify appropriate outcomes;
- helping collaboratives to build local financial support;
- providing assistance in grant writing;
- visiting sites and helping collaborative members to reflect on project developments, as well as meeting with mid-level administrators.

Publishing

- commissioning and providing papers on NCTM Curriculum and Evaluation Standards, MSEB, teaching mathematically unsuccessful students, and psychological research relevant to teaching of mathematics and cooperative learning;
- placing an article on the UMC project in the September 1987 issue of the Society for Industry and Applied Mathematics (SIAM) newsletter.

In September, 1987, EDC will initiate an Outreach Project as a part of the UMC project; the outreach effort will operate in conjunction with the Technical Assistance Project. The new Outreach Project will be responsible for spreading the word of the UMC enterprise to other relevant and interested communities. It will support the work of existing collaboratives and will encourage others to learn from or adapt a model of community-supported teacher development, and to integrate UMC ideas into the wider forum of education policy. The Outreach Project will produce a handbook on how to establish and sustain a collaborative, as well as papers and other publications on themes, trends, and insights gained by the UMC development. It also will revamp the newsletter and expand its audiences, and produce a videotape as a visual representation of its other materials.